OFFICIAL PROCEEDINGS
RAILWAY CLUB OF PITTSBURGH
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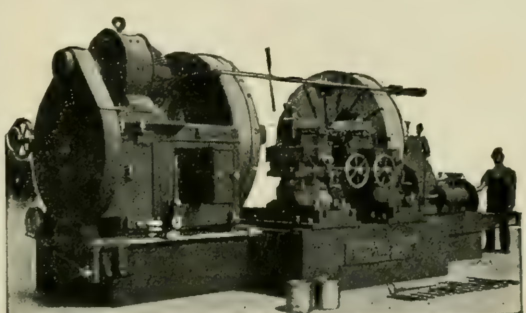
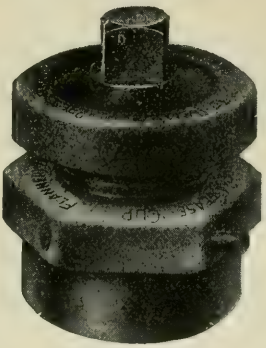
Vol. XXVI — NOVEMBER 29, 1926 — No. 1

THE HUMAN ELEMENT IN INDUSTRY
By MR. E. S. McCLELLAND, Director of Personnel of the Westinghouse Electric and Manufacturing Company.





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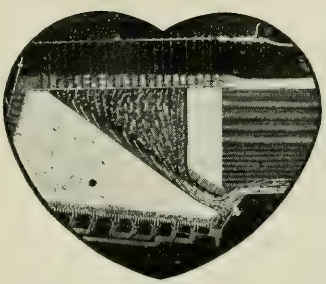

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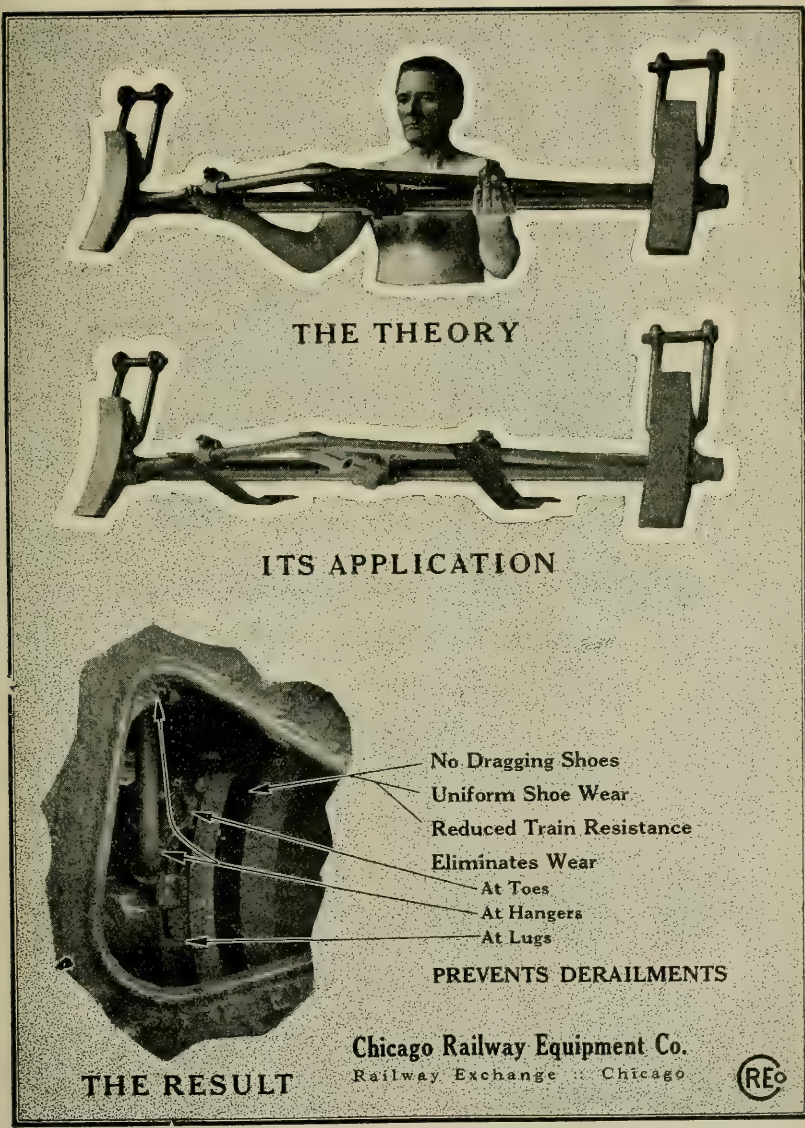
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OFFICIAL PROCEEDINGS
OF

The Railway Club of Pittsburgh

Organized October 18, 1901

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*J. H. McCONNELL	October, 1901, to October, 1903
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F. H. STARK	November, 1905, to October, 1907
*H. W. WATTS	November, 1907, to April, 1908
D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
*D. M. HOWE	November, 1917, to October, 1918
J. A. SPIELMANN	November, 1918, to October, 1919
H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
NOVEMBER 29, 1926

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8 o'clock P. M., with President George W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Allen, Harvey
Altsman, W. H.
Ashton, William A.
Beam, E. J.
Boiselle, R.
Christy, F. X.
Cooper, F. E.
Coulter, A. F.
Courtney, H.
Crenner, J. A.
Cunningham, R. I.
Cunningham, W. P.
Dambach, C. O.
Davis, Charles S.
Deckenbaugh, Andrew L.
Doescher, Louis
Emery, E.
En Dine, J. F.
Fike, J. W.
Fisher, G. M.
Fisher, J. J.
Follett, W. F.
Fritz, A. A.
Fults, J. H.
Gilg, Henry F.
Herrold, A. E.
Hickling, F. G.
Holmes, E. H.
Hyde, W. B.
Jordan, J. M.
Jungbluth, Adolph
Karns, C. A.
Kennedy, F. J.
Kummer, Joseph H.
Landis, William C.
Leonard, P. J.
Lewis, Walter M.
Lobez, Pierre L.
Lohr, A. W.
Loughner, George D.
Lynn, Samuel
Maloney, Joseph J.
Megogney, F. M.
Mertz, G. H.
Millar, C. W.
Mills, C. C.
Mitchell F. K.
Mitchell, W. S.
Moses, G. L.
McCune, J. C.
McGeorge, D. W.
McIntyre, R. C.
O'Connor, M. J.
O'Sullivan, John J.
Painter C. L.
Painter, Joseph
Palmer, E. A.
Passmore, H. E.
Peterson, E. J.
Posteraro, S. F.
Prouty, Eugene
Provost, S. W.
Purnell, C. S.
Rabold, W. E.
Rauschart, E. A.
Read, Harry J.
Reckley, A. P.
Redding, R. D.
Reeve, George
Richardson, H. R.
Ridgeway, J. F.
Rodgers, D. J.
Ryan, William F.
Sattley, E. C.
Sayre, F. N.
Schrader, A. P.
Shannon, David E.

Shellenbarger, H. M.
Sheridan, T. F.
Showalter, Joseph
Shriver, William
Smith, John L.
Smith, R. W.
Steele, I. H.
Sykes, A. H.
Tucker, J. L.
Van Blarcom, W. C.
Van Wormer, G. M.
Warner, Russell H.
Waterman, E. H.
Wheatley, William
Wildin, G. W.
Woods, Joseph
Woodward, Robert
Wright, O. L.
Zeher, W. G.
Zollinger, S. W.

VISITORS

Baker, H. M.
Cain, Percy
Clugston, W. L.
Collins, G. C.
Cooper, Thomas
Davis, William B.
Ferguson, Donald S.
Finn, Thomas A.
Forny, G. F.
Gibson, A. B.
Gorman, Charles
Gray, R. H.
Grubb, G. G.
Harris, Elmer F.
Meehan, C. L.
Mitchell, H. L.
Myers, A. M.
McCafferty, J. K.
McClelland, E. S.
McLaughlin, F. C.
McLister, H. J.
McMarten, Robert
Provost, William J.
Schrontz, Samuel
Sherrard, Henry M.
Shriver, C. E.
Strommen, T. H.
Thomas, Lewis
Turnley, F. C.
Warren, A. T.
White, C. G.
Yellard, John L.

PRESIDENT: The roll call will be dispensed with, the record of attendance being had from the registration cards.

If there is no objection, the reading of the minutes will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Cromwell, H. T., Assistant Shop Superintendent, B. & O. R. R., Glenwood Shops, Glenwood, Pittsburgh, Pa. Recommended by F. E. Cooper.

Currie, John, Storehouse Attendant, P. & L. E. R. R., 15 Commonwealth Avenue, Ingram, Pa. Recommended by John J. O'Sullivan.

Dempsey, P. W., Superintendent, West Machine Shop, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

Desch, John L., Sales Engineer, Clark Car Company, 1619 Oliver Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Grunnagle, R. S., Salesman, Hope Construction & Refining Company, 7945 Madeira Street, Pittsburgh, Pa. Recommended by A. F. Coulter.

Inman, M. B., Salesman, Westinghouse Electric & Manufacturing Company, 316 South Avenue, Wilkinsburg, Pa. Recommended by Graham Lee Moses.

Jones, William M., Clerk, Union Railroad, 5020 Glenwood Avenue, Hazelwood Station, Pittsburgh, Pa. Recommended by J. J. Fisher.

Johnston, George E., Clerk, Union Railroad, Box 92, Lincoln Place, Homestead, Pa. Recommended by J. J. Fisher.

Kilborn, James E., Special Representative, Bolt, Nut & Rivet Manufacturers' Association, 522 Farmers Bank Building, Pittsburgh, Pa. Recommended by G. W. Wildin.

Melvin, Charles G., District Manager, Galena-Signal Oil Company, 41 East Forty-second Street, New York, N. Y. Recommended by G. W. Wildin.

Read, A. A., Duquesne Slag Products Company, 806 Diamond Bank Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Simmon, K. A., Assistant to Manager Railway Sales, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Recommended by A. P. Schrader

Slack, H. E., Salesman, Doubleday-Hill Electric Company, 719 Liberty Avenue, Pittsburgh, Pa. Recommended by Joseph J. Maloney.

Smith, Frank D., Electric Railway Division, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by John B. Wright.

Smith, M. S., Purchasing Agent, Monongahela Railway Company, Brownsville, Pa. Recommended by J. E. Hughes.

Snyder, C. L., Salesman, Appleton Electric Company, P. O. Box 1581, Pittsburgh, Pa. Recommended by Joseph J. Maloney.

Stearns, Kenneth R., Railway Engineer, Westinghouse Electric & Manufacturing Company, 102 Berlin Road, Wilkinsburg, Pa. Recommended by H. H. Fenton.

Strommen, Theodore A., Engineer, Westinghouse Electric & Manufacturing Company, 138 Shaw Avenue, Turtle Creek, Pa. Recommended by R. W. Smith.

Warren, A. T., Engineer, P. H. B. & N. C. Ry., Evans City, Pa. Recommended by W. H. Altsman.

Wessel, Harry G., Foreman, Die & Mold Dept., Westinghouse Air Brake Company, Wilmerding, Pa Recommended by G. W. Wildin.

White, C. G., Supervisor, Aliquippa & Southern Railroad Co., 193 Clay street, Rochester, Pa. Recommendel by C. D. O'Connor.

Wynne, F. E., Manager, Railway Equipment Eng. Department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Recommended by A. P. Schrader.

PRESIDENT: These applications will be referred to the Executive Committee in due course, and upon approval by them the gentlemen will become members without further action than the payment of the current year's dues.

On November 16 about 300 members and friends of The Railway Club of Pittsburgh visited the East Pittsburgh Plant of the Westinghouse Electric & Manufacturing Company for an inspection of the Great Northern Railway Motor Generator Electric Locomotives. Inspection was also made of other interesting departments of the plant. At six o'clock the party was conducted to the dining room in the Westinghouse cafeteria building. Following the dinner hour Mr. M. B. Lambert, Transportation Sales Manager, acting as toastmaster, introduced Mr. F. A. Merrick, Vice President of the Westinghouse Company who extended an official welcome to the visiting Club members. Other short addresses were given by Mr. A. L. Humphry, President, Westinghouse Air Brake Company, Mr. E. D. Kilburn, Vice President and General Sales Manager, Westinghouse Electric & Manufacturing Company. Mr. G. W. Wildin spoke in behalf of The Railway Club, expressing appreciation of the courtesies extended. The evening was concluded by brief talks concerning the Great Northern Locomotives by Mr. F. E. Wynne, Manager Railway Equipment Engineering, and two of his staff, Messrs. Charles Jablow and C. E. Baston. Mr. H. K. Smith, General Railway Engineer, described briefly operations on the Virginian Railway since electrification of that company's lines.

The Secretary announced the death of a member of the Club, Mr. F. A. Klinefelter, who died September 24, 1926.

PRESIDENT: Appropriate memorial will appear in the Official Proceedings of the Club.

Is there any further business to come before the Club at this time? If not, we will proceed to the paper of the evening, which is entitled "The Human Element in Industry." This is a somewhat extensive subject, and ramifies every phase of humanity. It goes into the home, it goes into the schools, it goes into the churches, it goes into municipalities, banking, politics, and every other human activity, and especially is it so in industrial management. The author this evening will, however, mostly confine his remarks to the subject as applied to industrial problems, railroad and manufacturing. The rest of the field is rather large to ask him to cover at one meeting, although from my acquaintance with him I am sure he is perfectly capable of doing so. He will more especially bring to your attention the element which enters into management more than any other single factor, the human element. He is experienced, he is broad, he is not a theorist. He has arrived at the place where he now is through the school of hard knocks, and he knows what he is talking about. He has put something like 45 years of his young life into this work. He started back in 1881 as a clerk when the old Westinghouse Machine Company was organized. In fact he was the second person enrolled in that organization. He advanced step by step, through pattern making, foundry molding, machine shop, draftsman and chief draftsman, then chief engineer, then general superitendent, and then works manager. When the Westinghouse Electric and Manufacturing Company found it necessary to select a man to head their personnel department, they knew exactly where to go. They knew from the record of the speaker tonight that he was the man for them. He has made good in every place he has occupied, and he is now doing the same thing. I have pleasure in introducing to you Mr. E. S. McClelland, Director of Personnel of the Westinghouse Electric and Manufacturing Company, who will now address you.

THE HUMAN ELEMENT IN INDUSTRY

MR. E. S. McCLELLAND: Mr. Chairman and Gentlemen, I was afraid that in his introductory remarks the Chairman was going to read the postal notice which was sent out to

enveigle you gentlemen to this meeting. I refrain because of the fairy tale that was disclosed on that same postal card.

Mr. Wildin has told you that I have been in the game for a long time. I have I have had a large experience in manufacturing, designing and some salesmanship in my brief and checkered career. My present position with the Westinghouse Electric and Manufacturing Company is that of Director of Personnel. I have had a good many people say, "What in the heck is that? What do you do? What is your job and how do you go about it and where do you get wise to what you are trying to do?" And a lot of questions like that which you men are likely asking yourselves just now.

I want to read what Magnus Alexander, Manager of the National Industrial Conference Board with headquarters in New York City has said regarding the position of Director of Personnel, and when I am through you will agree that a Director of Personnel has a job. Mr. Alexander says, "The Personnel Director is that part of management that has the problem of creating and maintaining the spirit of the organization—of the founder—imbued with a spirit that breathes life into the organization. The one who preaches and practices harmony and unity—a big job—a real job." That is my job and that is some job, when you consider that in one plant we have 15,000 workmen, to say nothing of the men and women in our front offices in that same plant. The tonnage every day of human freight, in and out of that plant, is more than four times our monthly shipments of manufactured material, on the basis of 135 lbs. as the average weight of the individual that works for us. That is where you railroad men get in on us. You have to transport most of this human freight.

I am not going to bring you anything very new. Not very long ago I read in the "Silent Partner," a little magazine edited by Mr. Van Amberg of New York City,—"There are no new Thoughts." What I have to say has been borrowed or gleaned from many sources—authors and speakers who have said it or written it with much better equipment than myself. "The treatment of a subject is its only originality. No great thought has ever escaped the observation of the ages There is no new thought that is not an ancient mummy wrapped in the cloak of modern words. Solomon said it once, then Shakespeare revamped the thought, and, at last, you write it in your own way.

If the subject is timely, the presentation in sequence and the language simple and sincere; what you have to say about human nature was said in substance by Plato. What you write about or talk about in modern achievement, was predicted by Paul." So, I am not here to try to tell you anything that is new because all the old philosophers and sages have thought it over and written it down and we have simply neglected to read it or we would be as wise as they.

I am here tonight to talk on the subject of "Management Problems." I will name a few of them,—financing, production, distribution, cost finding, profits, losses. Under financing, there is the buying, selling, collecting and paying bills. Under production, designing, building, testing, shipping and erecting. Under distribution, direct to customers, to dealers, through jobbers to buyers and consumers. Labor, with all that the proper selection and training of the human being involves. A very casual observer may note a hundred or more items referring to labor alone that demands the attention of Management.

Tonight we are going to direct our attention to the "Human Element in Industry." We will leave promotion to the promoters, financing to the financiers, design to the engineers, farming to the farmers, preaching to the preachers, politics to the politicians, production to the manufacturers, selling to the salesmen, transportation to the railroads, education to the educators, crime to the police, lawyers and the courts; sports to the sportsmen, lubrication to the oil men and medicine to the doctors and surgeons, and give our attention primarily to the "man" that makes all this necessary and possible.

Let us catalogue some of the problems of industry, some of the responsibilities of industry, and here they are: They are positive, well defined, unescapable. To establish sound business policies; to finance the enterprise; to control the expenditure of funds; to develop an organization whose functions are logically assigned to competent indiivduals; to design, construct, test, ship, improve and warrant a product which is to be distributed in relation to demand and competition; to build or secure plant and equipment and utilize them economically and effectively; to secure adequate supplies of proper materials; to maintain a suitable supply of labor and supervise and co-ordinate its effect; to organize and sustain proper relationships between owners and workers; to formulate procedure based upon practicable and eco-

nomical methods; to manufacture and sell at a profit. It is difficult to select any one particular function of management as the more important one. They are so correlated and interdependent that they are practically inseparable. The human element enters into every one of these responsibilities.

We are living in a day of big and bigger business; we live in a day of big men; we live in a day of big ideas; we live in a day demanding fast movement. We use air mail for greater speed. Our means for transporting the power in the coal is too slow, so we build the electric plant at the mouth of the mine and transmit the power at lightning speed over a copper conductor. We use the radio for a still quicker mode of transmitting information. The very best of brain and voice and musical skill may be tuned in upon in our own homes, no matter how remote from centers of population. Institutions of learning are broad-casting educational programs that are rapidly raising the level of the intelligence of the people. The modern mind has been quickened into a new habit of thought. This habit is, in itself, a new problem for management to solve or, at least, direct. For these modern devices have made it imperative that management shall devise means of unifying its thought and effort so as to set its own house in order and, at the same time, participate in the World's business of which the individual management must assume it has a part. These evidences of speed and progress are making two appeals to society, namely, leadership—big and bigger men; co-operation—closer and more helpful. As the men of yesterday were big enough to recognize the changing order, so management today is sensitive to that same tendency with its accelerated speed Management today is sensitive to the fact that undeveloped resources do not increase. Management today is sensitive to the fact that new fields of resources are constantly diminishing. Management today is sensitive to the fact that we are on the threshhold of an intensive development of business. How sensitive is Management? How sensitive is Business?

Can we not liken the industrial division of our social organization as we find it today, to that intricate and wonderfully constructed machine of which the great poet and playwright said: "What a piece of work is Man! How noble is reason! How infinite in faculties! In form and moving, how express and admirable! In action how like an angel! In apprehension

how like a God! The beauty of the World! The paragon of animals."

Wonderfully designed, wonderfully constructed, wonderfully resourceful, wonderfully endowed with mind and heart and soul power; created in the image of God and yet a creature of this earth in his physical material form, sensitive to the natural changing conditions of heat and cold, hunger and thirst, sensitive to the last degree in his feelings, aspirations, ambitions and love for those nearest and dearest to him and, when properly functioning shows a broadening interest in all things pertaining to the welfare of the public of which he fully enjoys his share.

Sensitive to those outside influences that baffle him in his endeavors; puzzled because of his inability to control; chafing because of arrested or deflected progress, although fully aware of undeveloped resources within him, he presents a fair picture of industry of which he is a part, struggling to give expression to its latent possibilities.

If the human is a bunch of nerves, muscles, aspirations and desires, can we not place industry categorically in the same class? Equally sensitive to the outside influences which are beyond its control, and, because industry represents human effort; seek diligently to understand and overcome all such disturbing factors.

What is this thing we call "man?" I visited a moving picture theater some months ago, just to kill a little time, and I saw a most interesting picture thrown on the screen which will probably convey a kind of an answer to this question. As I entered the theater, there was thrown on the screen these words, "The Value of a Man," and, after a short lapse of time there came on the screen an interior view of a drug store with its prescription counter and its shelves with chemicals, syrups and other paraphernalia of a drug store Then a human hand appeared placing a mortar on the counter and a little later another human hand placed a pestle in the mortar and still the words, "The Value of a Man" remained upo nthe screen. By this time I was becoming interested, as your attention indicates that you are. Then a small animated figure of a man appeared on the right hand corner of the prescription counter and looked about. discovered the mortar, walked over and jumped into it disappearing beyond the range of vision. Then the human hands

grasped the mortar and pestle and proceeded to grind the man up. The mortar was then place dover an alcohol lamp and, after a lapse of time, steam began to flow out from the mortar, indicating that they were drying the man out. After the moisture had been extracted, one of the human hands poured out a little pile of dry substance upon the counter and the word "fat" appeared just over this substance and there appeared just below it a pile of laundry soap and these words came upon the screen, "Fat enough to make six bars of laundry soap." Still, the words, "The Value of a Man" remained upon the screen. Another pile of substance was poured out and the word "iron" appeared and a picture of a ten-penny nail and the words, "Iron enough to make one ten-penny nail." Another pile of substance was poured out and the word "Sugar" appeared on the screen. Then a picture of a glass of lemonade with a piece of orange floating upon its surface with the usual straws projecting from the rim of the glass and these words, "Enough sugar to sweeten one ordinary size glass of lemonade." Another pile of substance was poured upon the counter and the word "lime" appeared and then a picture of a whitewash bucket with whitewash dripping down over the side and the broken handle of the brush projecting from it and these words, "Lime enough to whitewash the interior of an eight-foot square chicken coop." Again the hand appeared and poured out a substance and the word "sulphur" appeared. And there appeared upon the screen the picture of a most forlorn looking dog and these words, "Sulphur enough to exterminate the fleas of a two months' old pup." Remember, there still remained upon the screen, "The Value of a Man." Then after an appreciable lapse of time these words appeared, "May be purchased in any drug store for 98c." "The Value of a Man!" What is it that makes a man valuable? It is not the substance from which he is created; it is not that which makes up the substance of this frame or house in which the man lives. It is the something that lives in this thing we call a "body." It is this thing we are talking particularly about this evening.

Some time ago a most interesting article appeared in one of the many society proceedings of the country in which Mr. John Calder called attention to the six "M's" of industry. They are these. If written down a blackboard would probably impress themselves upon your mind more clearly and definitely and in your imagination I will write them before you.

The first "M" in Mr. Calder's six M's of Industry was "men;" the second, "methods;" the third, "Morale;" the fourth, "Materials;" the fifth, "Machinery," and the sixth "Money." And then it was stated that 25 years ago or, probably less, that list would have been the other end up and the first consideration would have been "money," while now the first consideration and the emphasis is placed upon "men."

One of the most helpful things that has come with the complexity of our industrial life is the necessity, whether men like it or not, of taking part in others' problems. If moral considerations do not impel it, enlightened self interest does.

The tasks of production as they become more complex require constantly a more complete understanding of their character by the parties who participate in them.

Human experience in terms of history indicates that no institution endures in which there is not a body of beneficiaries to support the institution. The right to our property, and its protection, never endures among a people who have little chance to possess it. As you widen the base of opportunity for acquisition and improvement of conditions, you make more secure the foundations of the institutions that rest upon them. And one of the most striking characteristics of this period since the great war is the growing habit of investment and the diffusion of ownership among the American people.

We cannot solve industrial problems and write the answer on a blackboard.

We can only establish a tendency in human life by which relations between men and the common tasks of production will become better and better as we become more aware of our dependence upon each other. Greater authority invokes greater responsibility.

We are no longer a small body of owners of property, exploiting a large body of wage earners.

We are becoming the common owners of productive property and management from its lowest to its highest forms; and yesterday's laborer is becoming today's manager.

Our American industrial system is increasingly becoming based on the idea of self-respecting and mutually advantageous co-operation between employers and employees.

Yesterday the laborer looked forward to a steady job at good pay, and that was all. The white collar man looked forward to ownership of a business, partnership in a firm, or some position of responsibility that would distinguish him a little from the rest of the world. Today there is no distinction between classes except in the so-called smart set and to those of us who are not in it there does not seem to be much there. The laborer's son and the son of the big business man have an equal chance to sink or swim. Labor and the white collar class have merged. Today all classes look forward with much the same hopes and fears.

We have seen recently an increasingly greater emphasis being laid upon the human element in industry.

Lecture courses, magazines, books, schools and other means for developing workers for positions requiring a more intimate knowledge of the human being.

The instincts of the human are being analyzed and adjustments are being made as we get more light upon the subject.

We are recognizing more and more, the longing of the human for a freer expression of the soul that too long has been confined and restricted by an environment that has very gradually established a sort of caste even in this most democratic of all nations.

While we are bound to recognize the limitations of many humans, we are bound also to respect their inalienable rights to grow and develop to their maximum capacity.

We recognize the instincts of the normal human being as something akin to the primitive existence that enabled him to take care of himself in that state.

No other animal is so full of instincts as man.

Human behavior, says Plato, flows from three main sources: Desire, Emotion, and Knowledge. Desire, appetite, impulse, instinct—these are one. Emotion, spirit, ambition, courage—these are one. Knowledge, thought, intellect, reason—these are one.

Some one has divided human society into five streams; it is an arbitrary division, but it is rather convenient. There may be others that occur to you but these are outstanding ones as

we find society now organized. They are: The political stream of life; the economic stream of life; the social stream of life; the educational stream of life; the religious stream of life. Corresponding to these five great streams of life are the five great institutions of our civilization. Corresponding to the political stream of life is the state; corresponding to the economic (industrial) stream of life is the great organization of industry, trade and commerce; corresponding to the social stream of life is the home; corresponding to the educational stream of life is the school; corresponding to the religious stream of life is the church.

If all these sources are pure what a flood of pure unselfish service this old world would be able to render.

Civilization is determined by the guidance of these streams of life. To the extent we are successful in guiding the streams of life along normal constructive lines; civilization advances; to the extent that we fail, or allow any or all of these streams to become trhottled, civilization is retarded. Five different groups of men and women are directing these five streams of life. Politicians and statesmen (so-called) are directing the political stream. The great business leaders are directing the great industrial (economic) activities stream. The women are supposed to be directing the social stream. The schoolmen, teachers, and professors are directing the educational stream. The preachers are directing the religious stream.

If all these five streams are to flow full, every normal individual must act as a contributary stream.

The individual must contribute at flood height with a pure helpful product if the main stream is to be maintained.

If all these contributary streams are pure from source to mouth, what a flood of pure unselfish service this old world would be able to render.

Any of these streams fouled in the least degree and the whole stream of life is polluted.

The dangerous thing about the fouling of any one stream is, that, unless it becomes suddenly noticeably foul, its effect upon the whole stream may go unnoticed until irreparable damage has been done because of the subtle manner in which the contamination has been affected.

I have stood at the confluence of the Monongahela and Allegheny Rivers where they unite to form the Ohio River when one of the rivers has been running out at flood height, and have observed the line of color very clearly for a great distance before it was lost by complete mingling with the waters from the other river. Each river had its influence upon the other.

If both rivers were running out a flood height it was impossible to observe any line of difference.

Just as surely as no stream can rise higher than its source, no stream of life will ever be purer than the purity of its contributary streams.

In referring to "man" or "the human element in industry" we must take him as he is—we must accept him for what he is, we must take this raw material—analyze it, classify it, and place it where it will work to the advantage of the social structure as well as to the advantage of the industrial or commercial structure of our civilization. And to do this we must make ourselves acquainted with the instincts, animal and otherwise, that motivate the human being. Industrial leadership cannot rely on system and good-will alone, there are other factors which depend upon the possession and exercise of qualities, emotional as well as intellectual, on the part of the individual who would be successful as a leader. There is a place for the cultural values in industrial leadership. In the matter of men, all much alike but in degree differing. We must learn to recognize this likeness as well as the degree of difference.

To refer to a few of the instincts of the human being, which we are bound to recognize, if we give the matter any thought at all, we recognize the instinct of parenthood, the parental instinct, the love of family, of home. A man thinks of his family as part of himself; his success means their happiness. A workman with no home, or an unhappy home, is an unstable workman. Let us remember as we consider these instincts that a repressed insticnt acts as poison to our spiritual and moral natures. Let us remember that character, which is a priceless possession, is developed through expression of our human instincts, and let us remember also that attained character is a form of capital and that moral mastery is also a form of capital that cannot be purchased with money.

The instinct of self-respect or self-preservation is very

strong. The body is the organ of human activities. The mind has no means of communication with the world in which we live except through the body. Without the eye there is no light, no vision, no beauty; without the ear there is no harmony; without the ear the world of harmony would be silent. Without these senses or those of touch, taste or smell, the presence of any object would be absolutely unknown. The body is the soul's only medium of contact with the material world. It is one of God's most priceless gifts. Then should we not, individually, as leaders and as directors of others, be careful that this most wonderful machine be in the best condition at all times.

The instinct of workmanship, contrivance or construction is one of the instincts that today is being repressed because of mass production methods. This method does not give the workman an opportunity to express himself by workmanship that once belonged to the artisan or the mechanic who would not only conceive, design and produce something from his own brain and with his own hands, from which he could stand off and with pride say, "This is my work." We must do everything possible to revive and keep alive that desire to create, that joy of production that the workman has instinctively displayed when he was a small boy.

It is said that Stradivarius' friends made all sorts of fun of him because he spent so much time and took so much pains in making his violins. Today a Stradivarius anywhere in the world is worth from five to ten thousand dollars. Strandivarius is remembered among the immortals while the friends who criticized him sank into oblivion at their death.

The following is copied from George Eliot's poem, "Stradivarius."

"Stradivarius was a plain white-aproned man who stood at work, patient and accurate, for four score years, cherished his sight and touch by temperance. And since keen sense is love of perfectness, made perfect violins, the needed paths for inspiration and high mastery."

Gay, debonair Naldo, an artist, twitted him for his painstaking labor. To him Stradivarius replies:

"When any master holds
'Twixt chin and hand a violin of mine
He will be glad that Stradivarius lived,
Made violins and made them of the best.
The masters only know whose work is good;
They will choose mine, and while God gives them skill
I give them instruments to play upon,
God choosing me to help Him."

Naldo mockingly says: "What, were God at fault for violins, thou absent?'"

To which old Stradivarius answers:
"Yes; He were at fault for Stradivarius' work.
'Tis God gives skill,
But not without men's hands; he could not make
Antonio Stradivarius' violins
Without Antonio."

I give this as an example of pride of workmanship.

The instinct of ownership resides in every human being. The instinct of possession over against ownership. There is a distinction between these two words. As, for instance, some years ago I went into a restaurant owning an overcoat and possessing it. When I came out I still owned it. I did not possess it. Some one had helped himself to it. The instinct of property, of possession, or acquisitiveness is well defined in almost every human being.

Then there is the instinct of self-assertion, self-display, mastery, which is so evident in almost every human being, especially do we find it in our sons and daughters who, at the age of fifteen know more than their parents. Those of us who have children have experienced this as they have grown up. Boys and girls of fifteen and sixteen years of age at that age know more than their fathers or mothers ever dared know and are not slow to assert the fact, but, as they grow older and reach the age of twenty-eight to thirty, they wake up to the fact that father and mother knew something after all. But we must recognize these instincts. We must help to develop them along proper lines, realizing that there is no adequate self-expression without a reasonable amount of self direction.

The instinct of humility is found in the majority of human beings and, by this I do not mean that they fawn or indicate a desire to kiss your hand or follow you like a little dog. Not at all . But that expression of humility that we sense and, to a large degree, should appreciate in those in humbler positions than our own. We must recognize this instinct and I probably can illustrate what I mean by quoting from an article which I read some time ago, entitled "The Second Fiddle Carries the Air," using an orchestra as an example. The leader of the orchestra is not the whole show; he does not make all the music; he is simply directing the activities of the whole group from an advantageous position. The various instruments are coming in at their proper time and the whole orchestra is performing in a beautiful manner. But down there in an inconspicuous position the second fiddle is the instrument that is actually carrying the air, and by so doing, covering up many of the mistakes of other instruments in this imaginary orchestra. In every organization there are many "second fiddle" players that the limelight seldom shines upon, quiet, unassuming, carrying the air. A little encouragement or recognition for the "second fiddle" players often insures a better program. And now to the practical point of this particular instinct and its relationship to the whole. What would happen to the office force should the unseen and almost forgotten engineer refuse to turn on the steam in the building The entire orchestra or organization would chill up and quit cold.

Occupying an inconspicuous desk or working at some simple machine, you will always find a "second fiddle" player. Let one of these "second fiddle" members of the organization lay off; it is then that we realize that the music of the orchestra is not made by running the fingers through the hair or smiling and bowing to the applause.

I quite agree that it will do no harm to draw out the "second fiddle" man once in a while and more often have the whole orchestra receive the applause. Frankly, gentlemen, that is when my own applause is most vigorous, when the whole orchestra arises to receive the applause of the audience. I recognize, too, gentlemen, how difficult it is in an organization such as we are connected with, to have the whole orchestra arise, and yet it is within the range of possibility for each leader to recognize this instinct of humility, of willingness to follow and serve, in every right thinking man under his direction.

When we study the instincts of the human being we find that

instinct of the herd, that desire for association . We desire to be in one another's company and companionship. There is an old saying, "Birds of a feather flock together," or, as the new interpretation puts it, "Inhabitants of the ether, similarly plumed, gregariously assemble." Man is a gregarious animal and those of you who have any inclination to become leaders or better leaders must learn to control this instinct of the herd, to study the behavior of crowds or mob psychology, where those who are familiar with these things tell us of the possibilities of such leadership.

There are other instincts, such as pugnacity—that fighting quality we like to find in every worth-while man. A brand of self-assertion which may be wrongly developed as in the street fight, or the gunman, or realized as a great driving power as in a "Wilburforce" as he battles with the slave trade for 46 years and helps free, without a bloody war, all the slaves in the British Empire.

Then we must recognize that instinct of play which is inborn in the human being. The desire for relaxation which must be recognized and developed in order to round out a well balanced life.

Then the instinct of curiosity, of trial and error or thought, and the instinct of worship which we should recognize in all men.

So, gentlemen, if we wish to make the best of our lives and become leaders of men with a whole-hearted desire to help them develop to the very maximum of their capacity, we must give attention to the human as he comes to us. We must, as we look into the eyes of our fellow men, see back of them, a soul, a spirit, desires, longings, which impel us to extend to them every opportunity for growth upward. And now, gentlemen, after having listened to me as patiently as you have, what are you going to do about it? I think I can emphasize this question by relating the following story:

"One morning a Negro sauntered into the office of a white friend. "Good mawnin', Mr. Withrow. Kin I use yo' phone a minute?" he asked.

"Why certainly, Sam."

Sam called his number, and after a few minutes' wait said: "Is this you, Mrs. Whiteside? Well, I see in de papeh where you-all wanted a culled man. Is you still wantin' one? Then the

man youse got is puffectly satisfactory, and you doesn't contemplate makin' no change soon? All right, ma'am, Good-bye."

Mr. Withrow called to Sam as he left the phone. "Now, that's too bad, Sam, that the place is filled."

"Oh, dat's all right, Mr. Withrow. I'se de culled man what's got de job, but I'se just wantin' to check up on myself a little."

PRESIDENT: Mr. McClelland, I think you realize from the applause that followed your address that you have struck a responsive chord in this audience. And you have left a great deal of meat for thought with us. I hope they will all have something to say on this question. But before we call for general discussion, we have with us a few specialists we would like to hear from. I will first call upon Mr. McLaughlin, a representative of the International Correspondence School.

MR F. C. McLAUGHLIN: I do not quite know why Mr. McClelland asked us to come down to take part in discussion, but we are here and I might say something in the interest of the general application of some of his theories. For a number of years Mr. McClelland with some others, Dr. Bowman, Dr. Leavitt, Dean Connelly, have been active in what is called the Pittsburgh Personnel Association, which is really an organized effort to apply the theories Mr. McClelland has just expounded. If you will bear with me a few minutes I will read the Aims and Objects and Accomplishments of the Pittsburgh Personnel Association.

AIMS AND OBJECT: The Pittsburgh Personnel Association is established to advance the understanding of the principles, policies and methods of creating and maintaining satisfactory human relations in commerce and industry in the Pittsburgh district.

It stands for the principle that personnel work is an integral and inseparable part and responsibility of management interwoven into all of the efforts and activities of the production and sales departments and of the office.

The Association is affiliated with the American Management Association and with no other organization.

Its program consists of planning or fact finding and the dissemination of information, and its activities are controlled by a Board of Directors composed of local men.

ACCOMPLISHMENTS: The Pittsburgh Personnel Association has assisted in:

The establishment of a Central Placement Bureau, making complete records of minors available to the employers of Pittsburgh.

Promoting plans for securing the necessary supply of skilled and unskilled labor to carry on the work of the Pittsburgh district.

Encouraging the training of apprentices and the development of educational courses within industry.

Developing plans for decreasing excessive turnover.

Making a quantitative and qualitative study of the vocational demands of the Pittsburgh district.

Encouraging the development of Vocational Education by our local educational institutions.

The development of closer relations and understanding between our public schools and business.

Developing an appreciation and common understanding of the problem of human relations in the Pittsburgh district.

The study of the work of Foreman Training by representatives of eleven interested companies and the publishing of a report made from the minutes of the meetings.

Interesting the public in personnel work through talks broadcasted by radio and through newspaper articles.

Aiding people in other cities to organize Associations similar to this one.

The establishment of a Trade School for Girls and Part-Time and Apprentice Training Courses in the Public Schools.

In other words there is a practical application in a general way of the very fine theories that Mr. McClelland has explained to you, and I think this little report of the Personnel Association speaks for itself.

PRESIDENT: We have with us Mr. Gibson, of the Westinghouse Electric and Manufacturing Company, and we would be glad to hear from him.

MR. A. B. GIBSON: Mr. Chairman, I think it is very difficult to follow with a discussion a speaker such as Mr. McClelland,

who has apparently lived up to the reputation given him by our presiding officer this evening. However, I might dwell for a minute or two on one phase of the human relations problems in industry in which I have been most interested.

The problem of training is about one of the most important phases of the human relations problem in industry today. We must develop in the minds of the people connected with our organizations through training most of the ideals and background which Mr. McClelland has so ably presented to us as being important in a successful business relationship in industry.

As I sat here this evening I was thinking of the tremendous number of human beings who are involved in satisfying our human wants today. For example, the large number of people who have worked in one form or another in order that this room might have electric light so that we could enjoy the brilliancy of this meeting place.

The power for these lamps comes to us over the lines of the Duquesne Light Company. Back of these lines are the machinery in the power house; a large corps of people have worked to instill and maintain this equipment; and back of it all are untold numbers who have worked to manufacture the plant and equipment which makes such a development possible. We are living in an age when we are so dependent on the million of other people for our own simplest wants that only by a highly organized system of training and by a systematic educational endeavor can we keep the problem of industry abreast of the changing conditions and changing demands of business and industry.

Mr. McClelland devoted his whole attention to the importance of the development in industry of an ideal among its men, and it is my opinion that very definite attention should be paid to the matter of training by the American business man in order that these ideals may be established.

There are, I believe, three processes of training in industry which are essential. First, the training for a particular job; second, training for a trade; and third, general training for supervisory work.

Probably no industry is attempting to operate without conducting the first kind of training. Whenever we hire a man and put him on a new job he must be given instruction in its operation. Few organizations, however, consider this training as of suffcient importance so that it is conducted in a systematic way.

The second form of training, that of trade, has reached great importance during recent years, and, as Mr. McClelland has expressed it, we are losing the instinct to the craftsman. Our workmen have become so specialized in machine industry that they do not easily acquire an appreciation for the completed job. The problem, therefore, of training the workmen to understand all of the ramifications of a trade is most important.

The third form of training, that of training for supervisory work is becoming increasingly important.

As a member of the Pittsburgh Personnel Association, I have been interested in the training programs of business and industry in the Pittsburgh District and I am sorry to say there is comparatively little systematic training being carried on by the small industries of the District.

It is, therefore, the problem of such an organization as yours to co-operate with the Pittsburgh Personnel Association in promoting an increasing amount of attention towards systematic training in our local industries.

Many concerns employing 500 men or less believe that it is impossible for them to carry on systematic training due to the small number of employees involved. I might cite examples, however where a very complete program has been carried on by companies employing no more than one hundred people.

Probably the most outstanding of large concerns who have a complete training program are the Philadelphia Company, The Bell Telephone Company and the Westinghouse Electric & Manufacturing Company.

To return for a moment to the matter of apprenticeship training, it would probably be of interest to you to know that in most cases apprenticeship training pays for itself in productive labor of the apprentices. In the case of the Westinghouse Electric & Manufacturing Company I believe this is true. Am I not right, Mr. McClelland?

MR. McCLELLAND: It does pay .

MR. GIBSON: An outstanding example of a systematic training of a general nature is that being carried on by the Westinghouse Technical Night School. In this school there are complete courses of training along several important lines. A four-year engineering course is available for those who have com-

pleted a high school training or have had equivalent experience. A three-year junior engineering course is available for those who have not had the opportunity to attend high school. A two-year course in stenography is given for girls. A one-year course in calculating machine operation; a three-year course in accounting and business administration; and this year the Westinghouse Technical Night School have made available a course in commercial engineering which combines the engineering and accounting courses for those who desire to follow the commercial end of a business involving the handling of machines necessitating a certain amount of technical knowledge.

In the Pittsburgh District we have available through the Pittsburgh Public Schools evening instruction in many trades and for those who cannot attend school there are such organizations as the International Correspondence School. In short, there is no reason why everyone of our companies cannot be carrying on some kind of a systematic course of training.

If I am to leave any thought here tonight it would be that training is one of the biggest factors in bringing about the desirable condition of human relations which our speaker this evening has so completely analyzed.

PRESIDENT: We have with us Mr. E. F. Harris, Supervisor of Employment of the Mesta Machine Co. We would like to hear from him.

MR. E. F. HARRIS: Usually at a meeting of this kind I prepare to start an argument with the principal speaker, hoping thereby to provoke some further discussion and elicit a great deal more information from the audience. But Mr. McClelland has covered the subject so well and so fully this evening, and as I am in entire accord with practically all he said, I really haven't any argument to start. I can offer no new suggestion. I would rather listen to other speakers. I thank you.

PRESIDENT: Our time is getting a little short but I want to throw the subject open to general discussion by all the members who will take part. We would be glad to have any one make any remarks or ask any question that may occur to him on the subject.

MR. E. C. SATTLEY: I believe I voice the common sentiment when I say that we have been highly entertained and in-

structed by the forceful and intellectual discourse that has been presented by the speaker of the evening on the human element in management. Therefore, I would move that a rising vote of thanks be extended to Mr. McClelland for his splendid presentation of this interesting subject this evening.

MR. SAMUEL LYNN: I would like to second Mr. Sattley's motion. I feel that Mr. McClelland's talk' tonight has suggested much food for thought to men who are employed in a supervisory capacity and I believe I am expressing the sentiment of all of the members present when I say that I was sorry when he stopped speaking. Supervising men in all lines of industry in the Pittsburgh district have their problems and it is necessary for any man who is employed in a supervising capacity to keep in touch with the employes of his department and try to learn and do some of the things which Mr. McClelland is doing by devoting a portion of his time to the welfare work of the shop and to try and get in touch with the mental conditions of the men employed in the shop and get at their individual problems. By taking this interest in his men and by going into his particular problem, the workman gets a new and different attitude towards his foreman and the supervising man who takes the time and is able to bring out what is in the man's mind or what is troubling him, is doing much to get a satisfied workman and to keep a good workman in the shop, thereby reducing the turnover in the shop and the expense resulting therefrom. Mr. McClelland has given us a very inspiring talk tonight and I want to second Mr. Sattley's motion.

MR. JOSEPH PAINTER: Just a moment, Mr. President. I want to say a few words of an appreciative and commendatory character. I have been a member of this club since 1907. During that so very few of our members responded to your invitation. of any of our distinguished and highly respected Presidents. Even then occupying the floor each time possibly one and a half minutes. I mention this fact not as an excuse—rather a reason for my hasty interruption, more particularly, however, from the fact that so very fey of our members responded to your invitation. This only added to my feelings of regret that all of our membership had not been here not only to have heard the address delivered, but also we would have had more responses from the absent members, who are ever ready to eulogistically respond.

Yet, I do want to express my own individual appreciation of

the address from its beginning to the end. In its conception it is unique, its delivery fine, agreeably emphasized, impressively presented and the ideal therein "The Human Element in Business" beautifully carried throughout the whole address. I feel confident the sentiment, original ideas and practical instruction given, put into practical operation and fully demonstrated by himself and so cheerfully by his employes under him WILL LIVE in the minds of the membership of our club, employers and employes alike The beneficial results will be handed down to their successors and to indefinite future generations. We always do have speakers and addresses on important subjects pertaining to the activity of the club. Many of them eloquently delivered and highly instructive. Nevertheless, I must say I do not at the present time recall any that pleased me more than the one we listened to this evening.

Mr. President, I have not the least doubt that I voice the sentiment of the entire membership present when I assure the speaker that we all highly enjoyed his address, and that we will most heartily, and unitedly, respond favorably to the pending motion.

The motion prevailed by unanimous rising vote.

There being no further business upon motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

F. A. KLINEFELTER,
Died, September 24, 1926.

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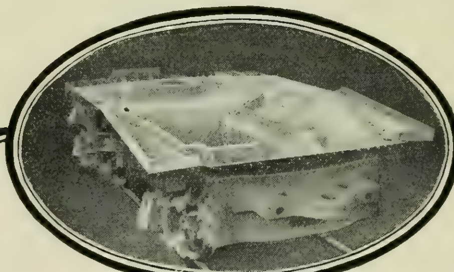
CAR RETARDING SYSTEMS IN CONNECTION WITH THE OPERATION OF HUMP YARDS.

By MR. W. B. RUDD, Engineer, Union Switch & Signal Company, Swissvale, Pa.



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F. G. MINNICK	November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
DECEMBER 23, 1926

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8:00 o'clock p. m., President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Allen, Harvey
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Bain, G. F.
Balzer, C. E.
Beam, E. J.
Berghane, A. L.
Blakley, T. M.
Boyle, Edward A.
Brice, J. A.
Christy, F. X.
Cooper, J. P.
Courtney, H.
Crawford, D. F.
Cruikshank, J. C.
Davis, Charles S.
Doescher, Louis
Emery, E.
En Dine, J. F.
Endsley, Prof. Louis E.
Eves, R. W.
Fritz, A. A.
Freshwater, F. H.
Gibson, D. W.
Gilg, Henry F.
Greene, W. F.
Gruitt, T. H.
Hansen, William C.
Holbrook, W. H.
Kessler, H.
King, C. F., Jr.
Laughner, C. L.
Lobez, P. L.
Lohr, A. W.
Landis, William C.
Lynn, Samuel
Maliphant, C. W.
Maloney, Joseph J.
Mitchell, F. K.
Mitchell, W. S.
Morse, J. W.
Moses, G. L.
Moyer, Oscar G. A.
Myers, T. P.
McElravy, J. W.
McLaughlin, H. B.
McManus, Charles J.
Painter, C. L.
Palmer, E. A.
Passmore, H. E.
Peterson, William
Pickard, S. B.
Prince, Albert
Redding, Philip E.
Rudd, W. B.
Ryan, William F.
Sanfillip, P. C.
Schrontz, Samuel B.
Shannon, W. R.
Shellenbarger, H. M.
Sheridan, T. F.
Simmon, Karl A.
Smith, R. W.
Sproull, C. W.
Stamm, B. B.
Stark, F. H.
Stewart, L. S.
Stevens, L. V.
Stoller, Karl M.
Strommen, T. A.
Stucki, A.
Thomas, Charles
Tucker, J. L.
Tuttle, C. L.
Van Vranken, S. E.
Van Wormer, G. M.
Walther, G. C.
Wikander, Oscar R.
Wildin, G. W.
Wright, John B.
Wynn, M. E.

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Dalzell, W. E.
Davis, William B.
Fisher, F. E.
Gray, A. E.
Grubb, G. G.
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Porter, P. P.
Reddick, Warren E.
Sewell, J. E.
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Spaith, W. F.
Stamm, J. Duncan
Tannenbaum, Max
Turnley, F. C.
Turreff, S. J.
Whittaker, C. C.

The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Crawford, G. M., Manager, Crawford Machinery Company, 817 Bessemer Building, Pittsburgh, Pa. Recommended by A. T. Warren.

Cusick, R. B., Supervisor of Track, P. & L. E. R R., 141 Eighth Street, McKeesport, Pa. Recommended by H. B. McLaughlin.

Dalzell, W. E., Asst. Planner, Pressed Steel Car Company, 1011 Milton Street, Coraopolis, Pa. Recommended by C. L. Laughner.

Faulkner, Andrew J., Interchange Clerk, B. & O. R. R., 4414 Coleman Street, Pittsburgh, Pa. Recommended by C. M. White.

Graham, James, Inspector, Pennsylvania Railroad, 906 Southern Avenue, Mt. Washington Station, Pittsburgh, Pa. Recommended by J. L. Cunningham.

Hill, W. D., Auditor, Monongahela Railway Company, Century Building, Pittsburgh, Pa. Recommended by Charles E. Hale.

Molyneaux, Dawes S., Designing Engineer, Fort Pitt Spring & Manufacturing Company, Box 58, Glenshaw, Pa. Recommended by J. D. Conway.

McDowell, C. G., Chief Clerk, American Railway Express Company, 200 Gross Street, Pittsburgh, Pa. Recommended by D. W. Gibson.

Nelson, R. F., Draftsman, Chartiers Southern Railway Company 1200 Century Building, Pittsburgh, Pa. Recommended by G. L. Moses.

Overstake, Leroy, Shop Foreman, Union Railroad Company, 411 George Street, Braddock, Pa. Recommended by W. F. Ryan.

Raymer, I. S., Signal Engineer, P. & L. E. R. R., 959 Fourth Avenue, Beaver, Pa. Recommended by J. A. Crenner.

PRESIDENT WILDIN: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action than the payment of the current year's dues.

Is there any further business to be brought before the Club at this time? If not, we will proceed to the paper of the evening.

I am very sorry to say that the subject which we had intended to have presented at this meeting could not possibly be prepared. The subject which I announced at the last meeting was The Relation of Train Control to the Air Brake. Mr. C. C. Farmer, Director of Engineering of the Westinghouse Air Brake Company, was in the midst of preparing this paper when he was suddenly called to the bedside of his brother in Schenectady, N. Y., who is very seriously ill. Fortunately we had a good reservoir to draw on, in our good friends in the Union Switch & Signal Company, and they have come to our rescue, so the paper this evening will be presented by Mr. W. B Rudd, of the Union Switch and Signal Company, specialist on train retarding devices, and the subject this evening is "Car Retarding Systems in Connection with the Operation of Hump Yards." The paper will be illustrated with moving pictures. I take pleasure in presenting to you Mr. Rudd.

CAR RETARDING SYSTEMS IN CONNECTION WITH THE OPERATION OF HUMP YARDS.

By MR. W. B. RUDD, Engineer, Union Switch & Signal Company, Swissvale, Pa.

The economy of present railroad operation is one of the outstanding accomplishments of the year, but if similar progress is to be made in the future, even further economies will be necessary. In the past few years it has also been shown as never before that Capital expended on facilities giving operating economies is Capital wisely expended. Further, investigation into the many fields of railroading seems to indicate that the most expensive portions of a railroad to operate are the various yards and terminals, both freight and passenger. Therefore, any device that will produce economies in yard operation should be of interest. The Car Retarder is such a device.

The subject of car retarders is, like train control, of interest to all departments of a railroad;—to the operating department, because it involves changes of methods and increases the speed of operation; to the maintenance department because it is another piece of apparatus to maintain; to the engineering department because it brings, in certain cases, new elements to be considered in yard design, and to the management because it results in large economies.

The car retarder for hump yard operation stands out as a remarkable achievement in effecting large economies and marked changes in yard operating practices. But few, if any, inventions have been conceived, developed and successfully applied in such a short period of time as has the car retarder.

In the early days of railroading, freight was handled from place to place by being picked up and set off by trains moving over the road. As traffic increased, yards were built and freight cars were classified by flat switching. Next, hump and gravity yards were built so that gravity would do a large part of the work formerly done by a switch engine. The next yard improvement was the application of power operated switches, centrally controlled, whereby one operator replaced a number of switch tenders. The latest improvement is the car retarder, which permits of a few operators doing the work formerly requiring a large number of car riders.

Let us differentiate here between the car retarder itself and the car retarder system. The car retarder itself is, in effect, a

car brake located on the ground, and, in this location, performs the same functions. It is an arrangement of brake shoes placed along side of and parallel to the track rails, which brake shoes are forced against the inside and outside faces of the car wheels either by compressed air acting on a piston or by an electric motor, through gearing, operating a driving bar. In either case, however, the movement is controlled electrically, and the operating mediums, through levers, transmit their force to the brake shoes. The resultant effect is the same as if either the hand brake or the air brake had been applied on the car, that is, the retarder, as its name indicates, reduces the speed of the car.

The car retarder system, on the other hand, includes the retarders themselves, the power operated switches, control machines, power supply for furnishing the operating medium, and sometimes power operated skate placing mechanisms. Auxiliary apparatus that is often used includes teletype machines, loud speakers, signals for controlling the movement over the hump, etc. It is, of course, essential that the classification yard be well lighted if the amount of business is such as to require night operation.

In such a car retarder system the retarders themselves are placed on the lead from the hump, at some points on the ladders and at one or more points on most of the body tracks of the classification yard. The exact location, as well as the number of retarders, is entirely dependent on local conditions of grade, curvature, wind, traffic to be handled, etc. Whatever retarders are necessary, however, are operated from towers, placed about the yard, each tower controlling its assigned group of retarders.

The location of the power operated switches is, of course, self evident, and they are also controlled in groups from the retarder operating towers.

The power operated skate placing mechanisms, when used, are placed one on each body track beyond the last retarder. They are for emergency use only, but are controlled from the same towers as the retarders and switches.

The control machines are placed in the operating towers, and the power supply is furnished at some convenient point.

Some of the economies derived from such an installation are obvious. Car riders, switch tenders, rider car operators and maintainers are eliminated. This considerable pay roll saving

is, of course, slightly offset by the relatively small total cost of the car retarder operators, power and maintainance of the apparatus.

Certain other more or less indeterminate savings may also be mentioned:

The reduction of personal injuries due to the elimination of car riders and switch tenders and, therefore, the attendant hazards of those occupations;

The reduction in car and lading damage, due to its being more feasible to train the few retarder operators to be expert judges of speed and impact than to train a large number of car riders to the same degree of perfection;

The reduction in extra switching as cars with defective hand brakes may be humped directly to the bad order track without being associated with a good order car which has later to be shifted from the bad order track into its proper classification;

The ability of the car retarder to operate with unimpaired efficiency in all kinds of weather, including sleet and snow;

The fact that maximum capacity of the hump is available at all times, as such capacity is not dependent on calling out additional riders;

The fact that the maximum capacity of the hump may be continuously utilized economically. At a test made in one yard equipped with the electro pneumatic system of car retarders 1105 cars in 721 cuts were humped in 5 hours and 34 minutes or an hourly average of 198 cars in 132 cuts.

All mechanical devices go through three stages, experimenting, developing and perfecting. The car retarder has entered this third stage, as we will shortly show you in motion pictures of the operation of Northbound Markham Yard on the Illinois Central Railroad, the most extensive car retarder installation yet made.

Before showing these pictures, however, I would like to briefly describe what they will show and call attention to the "high spots," which might otherwise be overlooked. The pictures show, more or less completely, the operation of Markham Yard from the time a train enters until the newly made up train departs.

At Markham Yard, as in most other yards, as the train pulls into the receiving yard the conductor drops off with his waybills and turns them over to the receiving yard clerk. At

Markham this clerk then sends the waybills to the General Yard Office, about three-quarters of a mile away, by pneumatic tube. As soon as received at the General Yard Office a switching list is made up from these waybills on a sending teletype machine. Receiving teletype machines, which exactly repeat what is written on the sending machine, are located in each of the five operating towers, in the hump director's office at the crest of the hump and in the superintendent's office in Chicago, twenty miles away. This switching list contains the initials and numbers of all cars in the train in the order in which they will be pushed over the hump, as well as the classification track to which the car is destined. So far, it is the same as the usual switching list for classification yard work. It further shows, however, a symbol for the approximate weight of the car, such as heavy load, light load, empty, etc.

In the meantime the caboose has been removed from the train and the train inspected and checked. It is now ready for humping.

The operating tower is one of the most interesting places in a car retarder installation. The pictures will show you the interior of one of these towers with one of the operators in action. The tower is so constructed as to give the operator a clear view in at least three directions, the control machine being directly in front of him. On this control machine are four rows of controls. The top row consists of a number of switches similar to those used on a telephone switchboard, and govern the skate placing mechanisms. The two middle rows consist of the levers used to govern the action of the retarders. Each of these levers may be operated to any one of seven different positions, five for the four pressures used (pressures four and five are identical at Markham), one for normal and one for "off" or release. The bottom row consists of two position switches which govern the position of the track switches. Each of these controls, whether for retarders, switches or skates, has a number plate, with the same number shown on a track and retarder diagram mounted in each tower, so that with the diagram even a green operator soon learns which retarders and switches must be used for certain tracks. In viewing the pictures showing the operatnig tower please note that the operator seldom glances at the control machine but manipulates the levers and switches simply by the feel in much the same manner as an expert plays the piano or operates a typewriter. In addition to the control machine

and located above and in front of the operator is a microphone and in one corner of the tower is a loud speaker. There is a similar outfit in each tower and in the hump director's office so that the hump director and the retarder operators are in communication at all times.

In the hump director's office there is also a signal control box, the controller of which governs the indications of the light signals by which the engineman of the hump engine regulates his movements.

The four pressures which may be used in the retarder cylinder, and thus obtain various degrees of retardation, are obtained and maintained electrically, using a circuit no more complicated than that of a door bell. The leverage arrangement transmitting these pressures to the retarder brake shoes is very similar to the leverage arrangement of the foundation brake rigging on a freight car, and the various pressures are admitted to the operating cylinder of the car retarder by energizing electro magnets instead of, as in the freight car, causing the triple valve slide valve and graduating valve to move. The release of the car retarder, however, is accomplished by admitting compressed air to the reverse side of the piston, instead of forcing the piston back with a spring as in the car brake cylinder.

To show the power and effectiveness of the retarder the pictures will show you a one hundred ton car brought to a stop in a retarder, which retarder is on approximately a 2.2% grade. The severity of the gradient is indicated by the promptness with which the car starts after the retarder is released. To stop this one hundred-ton car it was of course necessary to use the highest pressure available. It has been found that with this highest pressure it is possible to derail an empty car, although this rarely occurs in practice as the operator uses the lighter pressure to handle an empty car. And to show that this does work out in practice as well as to show the flexibility of the use of these various pressures the pictures show a most difficult load being handled with ease. This is a series of twin loads of long telephone poles in which there is practically no weight on the front truck of each car, but a considerable load on the rear truck of each car. The operator would therefore set up his retarder for light pressure. Then as soon as the front truck of the first car had left the retarder he would increase the pressure, but could only use this pressure on the rear truck until just before the first truck of the second car entered the retarder, when he

would reduce to the light pressure until this truck had left the retarder, repeating this cycle until the cars had passed through that particular retarder.

After the classifications, or a sufficient number of them, are built up, the cars are pulled from the classification yard into the departure yard, where the train line is charged and the cars again inspected previous to the arrival of the road locomotive. In the meantime the waybills in the General Yard Office have been sorted and arranged in order for the newly made up train, and sent, again by pneumatic tube, to the departure yard office. Here the outgoing conductor reports and receives his waybills, etc., couples his locomotive, makes a road test of the air brakes, and is ready to go.

MOVING PICTURES (Two Reels)

All of these pictures were taken during the normal operation of the yard and have, I hope, given you a general idea of the subject of car retarders. The details of application to both proposed and new yards are many and interesting, but would take entirely too much of your time this evening to discuss to a sufficient extent to be of any value. Thank you.

PRESIDENT: The subject is now before you for discussion, and Mr. Rudd will be glad to answer any questions you may wish to ask.

He told us, as I understand it, of a pretty large number of feet of car retarders, was it 7,000?

MR. RUDD: Yes, sir.

PRESIDENT: I thought you might have gotten it mixed up with the length of the tracks in the yard.

QUESTION: What is the approximate average distance between the cars traveling over the hump?

MR. RUDD: That is entirely dependent upon how fast you want to hump. In many yards previous to the retarder system, power operated switches were installed and the practice was to have track circuit protection with detector locking, so they could not possibly throw the switch under a car. That, of course, worked with an operator right at the hump controlling all the switches in the yard. With a retarder installation and the switch control grouped with the retarder control,—the track circuit protection is not necessary due to the fact that the switch is controlled by a man who can see the exact location of the car.

That may not seem to have anything to do with the gentleman's question, but it has. The object of the spacing between the cars is to get them far enough apart for the switches to be thrown between the cars, and not between the trucks of the car. At Markham with all the switches under the eyes of the operators, it is not necessary that they space the cars as far apart as when track circuit protection is provided or the switches are thrown by hand. At Markham there is not any definite spacing that they stick to or try to stick to; it depends considerably on the kind of car and the load. I have seen them at Markham successfully throw switches between cars when they were not more than 15′ apart, sometimes closer than that.

PROF. L. E. ENDSLEY: One of the things that enters my mind is what difference in operation is made for temperature. This morning if it is zero and tomorrow morning if it is 70°, so far as light, medium or heavy cars is concerned, is that taken care of? I know the co-efficient of friction of a car that has remained standing three or four hours at zero, will be considerably higher than on a train that has just pulled in.

MR. RUDD: That is where the question of four pressures comes in. In zero weather you would probably never use the highest pressure. The pressures are approximately 25, 50, 75 and 100. In cold weather with your heavily loaded car you may use your 50 lb. pressure, maybe only 25. If that gave you too much you would let it off and put it on intermittently. In extremely cold weather, it is sometimes the practice in yards equipped with retarder systems,—and I believe it is a common practice in other hump yards,—to warm the cars up by moving them back and forth before humping. Some roads are experimenting with hot oil in their journal boxes, or I should qualify that, hot oil applied to the journal itself, not to the journal box.

There is no question of course that cars do not run as well in the winter time. The general theory,—and I am glad that question came up,—the general theory of yard design for new yards has perhaps been changed considerably by retarders. Quite a number of existing yards have been built with what is known as a winter and a summer hump, the winter hump being much higher than the summer hump to give the cars a kick at the start; to give them in winter time the equivalent kick of the summer time. With retarders that is all changed. You do not need a winter and a summer hump. Build the winter hump and put the retarders on the hump lead and get the equivalent

of the summer hump in the summer time by using your retarders. In other words, push the cars over the winter hump but hold them down with the retarder so the speed at the bottom of the hump will be the same as it would be in the winter time over that same hump.

QUESTION: How many retarder installations are there in the United States?

MR. RUDD: Six, and the seventh is almost completed.

QUESTION: How many ought there to be?

MR. RUDD: I will answer that question with another one. Can you tell me how many hump yards there are in the United States? There are, though, certain hump yards where unquestionably the retarders will not be an economic proposition. We studied one yard where the entire yard is built on a .9% grade and the surrounding country is all on about that same grade. In that case you would have to put retarders every three or four hundred feet. You could not change the grade because you had to come out to the present grade somewhere. That simply meant that for that yard, you had to put in so many retarders that your first cost was too high and also that number of retarders would require a considerable number of operators and operating towers so the operating costs were too high to make it economical. Where you have yards like that, while I would like to see retarders, it would not be a good investment. But I think I can make this statement—that in most hump yards retarders are worthwhile and will pay.

QUESTION: How do retarders work on roller bearing cars?

MR. RUDD: We have never tried it. However, I see no reason why retarders should not work just as well with roller bearing cars. With a given pressure, you probably would not get as much actual retardation as with the present type of car, because the acceleration of the roller bearing car in a given distance is going to be more than the acceleration of the present type car, due to the fact that the roller bearing car is a car of less resistance. But suppose we had all roller bearing cars, it would simply mean a question of location and number of retarders in your yards. In other words you would have to engineer your retarder layout to take care of the acceleration of roller bearing cars rather than the acceleration of the present journal bearing cars.

QUESTION: Would it not seem that that smaller pro-

portional friction of the roller bearing cars would be a great advantage in operation?

MR. RUDD: In general operation, yes.

QUESTION: In hump yard operation?

MR. RUDD: Yes, you would get a quicker separation of the cars while going through the leads and switches. Then again, of course, comes in the question if the roller bearing cars get to be general, of the neutral grade. The ideal retarder yard is one in which the grade of each body track soon after it leaves the switch is a neutral grade in the summer time. That has pretty definitely been determined to be just about .3%, that is for present equipment. For roller bearing equipment, it would probably be less than that. I have not seen any figures, although I presume there are some, on the resistance of roller bearing cars. I think, however, as far as retarders are concerned, it will be a number of years before we have roller bearing cars in very large numbers in freight service.

MR. F. H. STARK: If all the yards were equipped with retarders, what effect would it have on the outside of the flange and the inner edge of the wheel, both being soft iron?

MR. RUDD: That is a question on which we have no actual figures or definite information, but I cannot conceive of that having any material bearing. Of course there is no question that you wear the car wheel. If you do that amount of work on the car wheel, you are bound to wear it. But the length of time a car is in the retarder and getting this wear is so very small that I do not think it will have any effect. Of course, on the outside of the wheel, it will not make any difference. There are very few wheels condemned on account of defects on the outside of the wheel. They are mostly condemned for so called sharp and for thin flanges. The flanges would be the only parts where the retarders would have any bearing. It might increase slightly, but certainly not materially, the number of wheels that would have to be removed for thin flanges. I may be wrong but that is my personal opinion.

QUESTION: The shoe pressure is what per cent of the actual weight of the car, when you have 100 lbs. in the retarder cylinder?

MR. RUDD: The shoe pressure on a truck at 100 lbs. is somewhere around 120,000 or 125,000 lbs. That is distributed over four wheels and on two sides of each of these four wheels.

QUESTION: That gives a braking pressure of probably

150% of the maximum retardation that you would get with normal effort?

MR. RUDD: I do not know, I have not worked it out.

QUESTION: I was wondering what the relative deceleration of the car with the retarder was as compared with emergency application deceleration and independent of the adhesion of the wheel to the rail.

MR. RUDD: I do not think it is very much, if any, greater than the emergency application. That 100-ton car that you saw stopped was going, I suppose, about four or five miles an hour. That car stopped in about 60′. May be some of the Air Brake people can tell how quickly a K2 triple would stop a 100-ton car?

MR. ————: An emergency application would stop it instantly.

MR. F. H. STARK: If you will allow an ex-railroad man to say something, I do not want to depreciate the achievement of the Signal Company, but about fifteen years ago we felt the need of something like this and we conceived the same principle and we had in mind what would be something like two guard rails forced apart with air and possibly springs and have them located at intervals below the hump. We had in mind the application on the inside of the flange only. The question naturally arose as to what effect it would have on the wheels, with the excessive pressure on one side of the wheel. I submitted the plan to my friend, Mr. Stucki, and he concluded that there was nothing in it. I also showed it to Mr. Dave Redding of the P. & L. E. and he told me they tried it out twenty years before and that is thirteen years ago now. The P. & L. E. R. R. installed it at McKees Rocks. They had an inclined coal chute and they located one of these retarders at the foot of the incline and then dropped the empty cars down from the coal chute, and he said you would not know the retarder was there. So from Mr. Redding's experience and our lack of vision, we dropped it, and I find now that somebody else has developed it and made it a success, much to their credit.

I was so much interested in the question of retarding cars at that time that I went to Lorain, Ohio, where the Lake Terminal Railway operated a hump classification yard, and the superintendent told me they did not need any riders. I thought he was coloring the statement so the engineer of the road I was

with and myself went up there and they brought a cut of cars and put them over the hump so fast that we did not realize it until the whole cut had gone on down into the classification yard. I said, "Here, we will have to have another cut brought around," so they did, and we got our watch out and timed them and they put sixteen cars, on the average, a minute over the hump. And down in the classification yard you could see the whole 30 or 40 cars all moving along slowing down gradually. Then a yard engine took the cars away from the classification tracks and they brought around another cut. I said, "I can't believe it but it is there." The only way I can account for it is that all the cars were of the same type with the same approximate tonnage with plenty of room in the classification yard. We later built on the east end of the Montour Railroad a duplicate of the Lorain yard as nearly as we could. After we had it all completed and brought the first train down, I said to the Superintendent, "I will stay down in the yard and you cut them off and if I see that they are coming too fast I will give you the high sign. The cars were mixed—steel hoppers, gondolas and some wooden cars, and they commenced to come over the hump and as the yard tracks were being filled up, the cars kept bumping harder and harder, knocking the coal all over everywhere. So we gave that up as a bad job and had to employ car-riders. It is interesting to know that somebody has taken the matter up and developed it and made a success of it. The increase in number of cars that can be handled over one hump with the system installed and the saving in pay-roll ought to make it profitable at large terminals.

MR. RUDD: I think I have an apology to make. I said a while ago that practically nothing, or very few devices had been invented and successfully applied in such a short time. I will have to take that statement back. It was not so short a time after all.

MR. STARK: We were going to apply it to the inside of the wheel only and of course it would not have the same effect at all.

MR. RUDD: I might say that the first installation of the retarder,—the experimental installation that really made it a success and from which it has grown,—was made at Gibson, Indiana, on the Indian Harbor Belt Railroad. Mr. Hannauer was vice-president of that railroad and will be president of the Boston and Maine on January 1, and he really developed the

first successful retarder and installations since have been developed more or less on his idea.

QUESTION: At the Markham Yard how many cars are under the observation of the operator at one time? How mnay cars does he have to watch? I noticed he was looking right and left pretty rapidly and I felt that he was trying to watch them all at the same time.

MR. RUDD: That tower you saw was No. 1 and he gets all of them. I suppose he might have eight or ten. I am getting some new questions shot at me tonight.

In the picture you saw, the control limit of the tower is just beyond where the operator is looking, at the right, and he has to give the cars their initial spacing so they will be far enough apart for the fellow down the line to give them what additional spacing they may need. And he has got to control these cars so they will not be too fast for the other fellow to control. That is one advantage of the loud speaker. You will often hear these fellows talking to one another. They sometimes get a mistake in the switch list. A car will be shown on the list as an empty; may be it is loaded. The first operator finds it is going faster than it ought to go. He will step on his loud speaker and say such and such car is a heavy load instead of an empty, which gives the other operators warning. Or it may be the other way around. Further, the switching list is made up independently of the inspection of the train, and, of course, does not include any bad order cars unless they are so reported by the conductor. Any bad order cars that are disclosed by the inspection are not on the switching list as bad order cars. The result is that when the yard master gets his instructions, which he gives to all the towers at once, he gives instructions as to what track of the receiving yard they will now hump and probably as they are humping the train he will tell them certain cars are bad order cars and the operators simply mark on the switching list B.O., instead of the number of the track, 19, 17, 12 or whatever it is and send the car to the bad order track accordingly. That is the particular advantage of the loud speaker.

QUESTION: How does the tower arrange for the return of the skate put out in emergency?

MR. RUDD: They have to be brought back manually. With the skate that is used at Markham the car has to be

pulled back off of that skate before it can be removed. The result is after you have used the skate you have got to trim The operator steps on the loud speaker and tells the hump director he has skated such and such a car. It is up to the hump director then. It depends on the cars still remaining to go over the hump but generally the humping engine follows the train over the hump and does such trimming as is necessary. At Markham so far they are only using two tricks in the north-bound yard handling 1600 to 1800 cars a day, and I have never seen them pushed yet. We do not know how many cars they could classify if they had to. They can keep the receiving yard clear and yet afford to lose time in between trains.

QUESTION: What is the material used in the shoes?

MR. RUDD: At present it is the same material as is used in car brake shoes, cast iron. But experiments are being made which seem to indicate—experiments made with soft steel shoes—that the steel shoe is a little bit more effective than the cast, and of course wears very much less, that is, it will wear a very much greater length of time before it needs renewal.

QUESTION: How much above the rail is the top of the shoe?

MR. RUDD: Two inches. There is a retarder used in Germany that works on a little different principle, hydraulically operated. They have a big advantage in that they grip 5″ above the top of the rail. If we could do that we would have about the equivalent of an emergency brake.

QUESTION: How does the control man in the tower keep track of his cars? How does he know where to catch them in the yard?

MR. RUDD: He has to watch them. You are thinking of a dense fog are you not? About the only way I can answer that question is that a dense fog is going to slow you down just as it slows you down now with riders. I do not think it will slow you down much more. At Gibson and Markham, of course, the yard is lighted, probably better than most present yards that are operating with riders, which has something to do with it.

QUESTION: How are the four pressures obtained? With four wires to each machine?

MR. RUDD: Yes, four wires. There is a little pressure

controller in the retarder operating mechanism which is always in communication with the operating side of the brake cylinder. It uses Bourdon tubes such as are used in air guages and to those tubes are attached contacts. They are adjustable contacts so that when you set a contact for 25 lbs. and put your controller handle on that position that energizes the magnet that admits air to the operating side of the cylinder and as soon as the pressure in the cylinder gets up to 25 lbs. that Bourdon tube will straighten out enough to break that contact and as soon as the contact is broken the electro-magnet is de-energized closing the admission of air to the cylinder. At the same time you energize that admission magnet you also energize the exhaust magnet which in the normal position established communication between the atmosphere and the operating side of the cylinder. In the normal position of the retarder nothing is energized. You are not consuming any energy. That same thing applies to every step up of the pressure. The fourth is the straight line pressure.

QUESTION: What power is used to open the retarder?

MR. RUDD: Full line pressure. A trunk piston construction is used so there is only half the volume used on the return of the piston that you would use in pushing it out, with the same pressure.

PRESIDENT: I notice you did not make any mistake in coupling cars as they went down those tracks. Was that arranged for the occasion or is that normal operation?

MR. RUDD: That is the normal operation, but like all other rules, there are exceptions.

PRESIDENT: I did not see any exceptions. I did not see any engine there to overcome them.

MR. RUDD: You missed one. In one of those impact pictures, one car coming into the other, the two cars did not quite couple. You could see all three cars moving off but you could see a very slight difference in the spacing between the cars. Unless you knew it you would not notice it.

PRESIDENT: But I saw no operation to couple them up, no trimming as you call it.

MR. RUDD: The trimming is, in most cases, I would say, less than with rider operation.

PRESIDENT: I would think so. I think it all depends on how the cutter leaves the knuckle.

MR. RUDD: Yes, sir.

PRESIDENT: You used another expression and I am going to betray my ignorance by asking what it means. You spoke of a mechanical hump. What do you mean by a mechanical hump?

MR. RUDD: It is an arrangement at the crest of the hump itself of levers and hydraulic jacks in which the rail is in either three or five sections and in the winter time if you want to get a little greater kick out of the car you lift up on the jacks and that raises the crest of the hump about 12″.

PRESIDENT: I am familiar with that but it was the term I did not recognize.

Gentlemen, our time is growing short. If you have any more questions you would like to ask, kindly speed them up a little so we can close the meeting at the proper time. I do not want to shut off discussion at all, but merely to accelerate it.

MR. D. F. CRAWFORD: I would move a vote of thanks of The Railway Club of Pittsburgh to Mr. Rudd for his very excellent presentation of a most interesting subject, and also to the Union Switch & Signal Company for the fine moving pictures that have been shown.

The motion prevailed by unanimous rising vote.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

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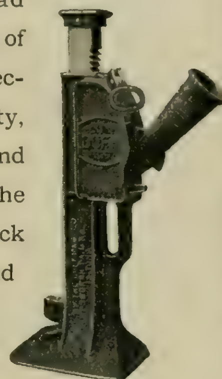

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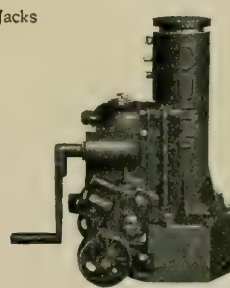

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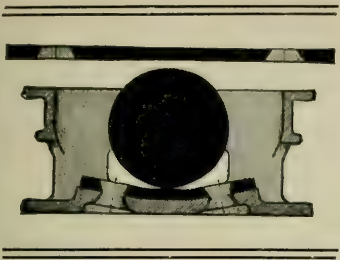
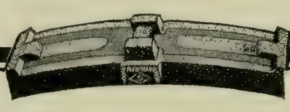
Vol. XXVI — JANUARY 27, 1927 — No. 3

TRANSPORTATION AND EDUCATION

By F. L. BISHOP, Dean, School of Engineering, School of Mines, University of Pittsburgh.





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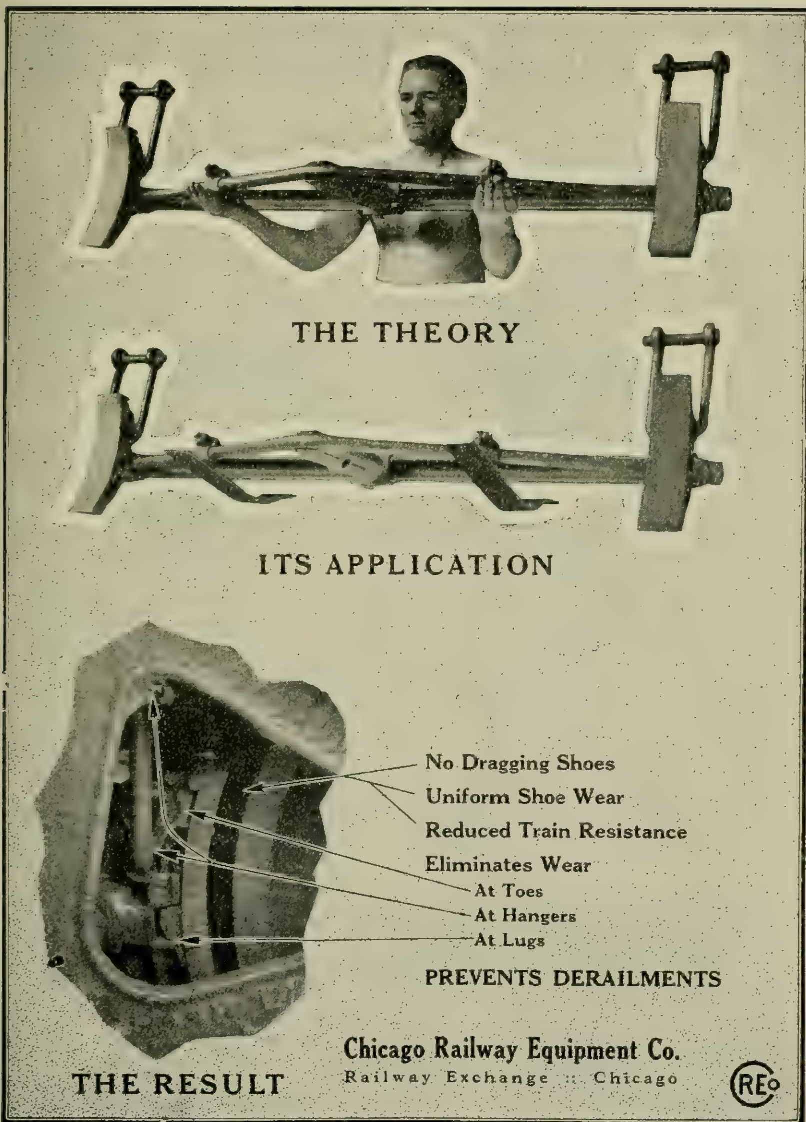
THE THEORY
ITS APPLICATION
No Dragging Shoes
Uniform Shoe Wear
Reduced Train Resistance
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At Toes
At Hangers
At Lugs
PREVENTS DERAILMENTS
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Pittsburgh, Pa., January 27, 1927
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Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
JANUARY 27, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8:00 o'clock p. m., President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Allen, E. J.
Allen, Harvey
Allison, John
Altsman, W. H.
Anderson, A. E.
Austin, F. S.
Beam, E. J.
Bednar, J. J.
Brinkhoff, W. H.
Burkley, H. S.
Burnside, C. J.
Campbell, J. E.
Cannon, T. E.
Champion, Joseph H.
Cooper, F. E.
Cotter, George L.
Crawford, D. F.
Cunningham, W. P.
Dalzell, W. E.
Dambach, C. O.
Davis, Charles S.
Doran, F. E.
Edwards, C. H.
Emery, E.
En Dine, J. F.
Endsley, Louis E.
Farmer, C. C.
Fenton, H. H.
Fisher, G. Malcolm
Fisher, J. J.
Frey, W. H.
Fritz, A. A.
Fultz, J. H.
Geddes, James R.
Geisler, Joseph J.
Glaser, J. P.
Greene, W. F
Guignan, W. E.
Hale, C. E.
Haller, Nelson M.
Haskell, B.
Heinlein, George J.
Hollingsworth, C. N.
Holmes, E. H.
Houston, Charles
Hughes, J. E.
Hunter, B. E.
Jacobs, M. H.
Johnston, W. A.
Jones, Richard I.
Jordan, J. M.
Kerby, Frederick
Kimling, Carl
King, J. W., Jr.
Kroske, J. F.
Kummer, Joseph A.
Landis, W. C.
Lehr, Harry W.
Leonard, C. W.
Lewis, Walter M.
Lobez, P. L.
Lohr, A. W.
Lyman, L. S.
Lynn, Samuel
Marlow, G. A.
Megogney, F. M.
Miles, H. E.
Millar, C. W.
Milliken, Col. James
Mitchell, Frank K.
Mitchell, W. S.
Morris, J. H.
Moses, G. L.
Muir, R. Y.
Myers, T. P.
McGann, J. F.
McIntyre, R. C.
McNiff, John L.
Norris, J. L.
Overstake, Leroy
Painter, C. L.
Painter, Joseph

Patterson, J. E.
Peterson, E. G.
Pickels, H. D.
Posteraro, S F.
Pringle, H. C.
Provost, S. W.
Purnell, C. S.
Rauschart, E. A.
Read, A. A.
Reckley, A. P.
Reddick, Warren E.
Reeve, George
Reynolds, D. E.
Rogers, Robert
Rushneck, G. L.
Sattley, E. C.
Schultz, Charles H.
Shannon, David E.
Shellenbarger, H. M.
Sheridan, T. F.
Simon, Philip
Smith, E. E.
Smith, J. L.
Snowden, H. J.
Spielmann, J. A.
Stebler, W. J.
Strachan, M. B.
Strommen, T. A.
Sutherland, L.
Van Wormer, G. M.
Warner, Russell H.
Warren, A. T.
Waterman, E. H.
Weissert, W. J.
Wheatley, William
Whipkey, D. L.
Wikander, O. R.
Wildin, G. W.
Wright, O. L.
Wyke, J. W.
Wynn, M. E.

VISITORS

Bayer, Carl
Campbell, C. H.
Carlson, L. E.
Clugston, W. L.
Davis, William, B.
Derker, A.
Elkin, W. C.
Farmer, George C.
Flinner, D J.
Gemmell, R. T.
Goggins, John J.
Gordan, George
Hildebrand, L. B.
Howe, Harry
Klassen, Fred G.
Langood, A. M.
Leisenringer, W. J.
Lewis, S. B.
Macoubray, R. J.
Marsh, F. E.
Mathis, B. H.
Milner, W. M.
Misner, George W.
Morse, Dr. F. L.
Myers, Charles C.
McConnell, A. L.
Parkes, E. T.
Prentice, A. L.
Provost, W. J.
Rintoul, Richard
Shelly, O. L.
Sherrard, H. M.
Smith, Sion B.
Steele, Charles E
Supermann, C. W.
Wentworth, E. F.
White, R. H.
Whittemore, C. R.
Wilkinson, W. W.
Wright, G. M.
Young, F. C.

The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the

previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Bald, E. J., General Foreman, Westinghouse Electric & Manufacturing Company, 2105 Lloyd Avenue, Swissvale, Pa. Recommended by A. P. Schrader.

Coy, S. C., Jr., Clerk, Operating Department, P. & L. E. R. R., 230 Laredo Street, McKeesport, Pa. Recommended by S. W. Zollinger.

Gordon, George A., General Foreman, P. & W. Va. Ry., 56 Oakwood Road, Pittsburgh, Pa. Recommended by T. E. Cannon.

Howard, L. F., Chief Engineer, Union Switch & Signal Company, Swissvale, Pa. Recommended by G. W. Wildin.

Howe, Harry, Special Engineer, Pressed Steel Car Company, 679 Orchard Avenue, Bellevue, Pa. Recommended by Felix A. C. Koch.

Kellenberger, K. E., Union Switch & Signal Company, Swissvale, Pa. Recommended by W. B. Rudd.

MacDonald, William C., Special Agent-Contracts, Pennsylvania Railroad System, 254 Allison Avenue, Emsworth, Pa. Recommended by W. E. Perry.

Mathis, B. H., Treasurer, Warren Tank Car Company, Warren, Pa. Recommended by Joseph H. Kummer.

Nuth, George, General Yardmaster, Mon. Con. R. R. Co., 3540 Second Avenue, Pittsburgh, Pa. Recommended by James R. Geddes.

Reddick, Warren E., Clerk, P. & L. E. R. R., 1114 Faulkner street, Corliss Station, Pittsburgh, Pa. Recommended by J. E. Hughes.

Watts, Charles J., Manager, Watts Brothers Tool Works, 157 Bevington Road, Wilkinsburg, Pa. Recommended by G. W. Wildin.

PRESIDENT WILDIN: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action than the payment of the current dues.

If there is no further business to be brought before the meeting we will proceed to the paper of the evening. We have with us one of the most eminent engineers of this country, a man who has spent a great many years in the engineering educational work. He is connected with one of the largest educational institutions in the state. He has been for fifteen years the Secretary of the Engineering Educational Society. And he is therefore eminently fitted to talk upon the subject on which he will address you tonight. I take pleasure in introducing to you Dr. F. L. Bishop, Dean of Engineering and Mining, of the University of Pittsburgh, who will address you upon the subject of "Transportation and Education."

TRANSPORTATION AND EDUCATION

By F. L. BISHOP, Dean,

School of Engineering, School of Mines, University of Pittsburgh.

For thousands of years man's only relief from carrying himself consisted in beasts of burden, draft animals, and water craft of various kinds. Then about 150 years ago came an industrial crisis in England. The coal mines had reached such a depth that many were abandoned because the water could not be pumped out by hand. James Watt invented the steam engine to operate the pumps. The application of this new form of power was made to the locomotive by Stephenson something over 100 years ago. This invention not only revolutionized transportation but it changed the face of civilization.

We, who live in this mechanical age when the most marvelous things such as talking from New York to London hardly create a ripple in the public mind, can not comprehend the superstitious dread and even terror with which almost everyone a hundred years ago looked upon the advent of a new mechanical devleopment. This is illustrated by the first trip of the "Clermont," Fulton's first steamboat:

The "Clermont" used dry pine for fuel. It was described "as a monster moving on the waters defying wind and tide, and breathing flames and smoke." This uncommon sight first attracted the attention of crews of other vessels. Notwithstanding the wind and tide, they saw, with astonishment, that it was rapidly moving towards them. Many left their vessels to go on shore and besought Providence to protect them from

the horrible monster which was marching on the tides and lighting its path by fires which it vomited.

The first trip of the "Clermont" represents quite clearly the unfavorable attitude which the public had in regard to not only steamboats but to railroads when they were first introduced.

A dramatic incident occurred in the early history of railroads which had much to do with the favorable reception by the public of this mode of transportation. This occurred at the opening of the first railroad in England, running from Manchester to Liverpool:

Robert Stephenson and Company had built for the line seven locomotives beside the "Rocket" and a large number of carriages. These were all brought out in procession and 600 passengers entered the train which started for Manchester and ran at times at the rate of 20 to 25 miles per hour. The train stopped for water and the occasion was taken to send the engine driven by Stephenson himself on a side track with a car containing the Duke of Wellington, and the other engines and trains were directed to be sent along the main track in view of the Duke and his party. Mr. Huskisson, a Member of Parliament for Liverpool, who had carelessly stood on the main line until the "Rocket" which led the column had nearly reached him, attempted to enter the carriage of the Duke. He was too late and was struck by the engine, thrown across the rail, and the advancing engine crushed a leg so seriously that he died the same evening. Immediately after the accident, he was placed on another train and Stephenson made the 15 miles to the destination of the wounded man in 25 minutes—a speed of 36 miles an hour. The news of this accident, and the statement of the velocity of the engine, were published throughout the world and the misfortune of this first victim of a railroad accident was one of the causes of the adoption and rapid spread of the modern railway system.

Favorable public opinion has since medieval times been vital to the success of any undertaking. Though they did not know it, the pioneers who built railroads in this country owed their outstanding success to public sentiment favorable to their plans and projects. This favorable public opinion was a normal outgrowth of the desire of the pioneers to push westward away from the Atlantic seaboard.

If you take an outline map of the United States as it was 100 years or more ago and plot on it the population, you will find that it is scattered along the Atlantic seacoast and in cer-

tain sections just west of the Allegheny Mountains. If now you draw in the rivers of the country, you find that they pass through the centers of population and that the population dwindles as you go toward the source of the rivers. In other words, the population followed the rivers. You will find on these early maps the region west of the Mississippi marked the Great American Desert. A study of a map of this kind gives us a measure of the ambition of the people to spread westward. They were therefore in a happy frame of mind to adopt methods of transportation which would carry them over the mountains and across the plains. The railroad was the answer. When the railroads came the people no longer followed the rivers, but followed the railroads. Some of the cities and towns made great by the waterways were unmade by the railroads and new cities and towns sprang up in the sections of the country that they crossed.

The railroads created modern industry in this and other civilized countries and still continue to be the foundation upon which the prosperity and in fact the existance of the farm, the mine, the factory and all other forms of organized industry rests.

During the construction period the leaders in transportation saw in the advent of the railroad the waving of a magic wand that multiplied their possessions a hundred fold. They saw an empire to be occupied that would give to their roads millions of passengers and billions of tons of freight. The land owner and the community gave right-of-ways, cities, counties, states and the federal government voted aid of various kinds to assist in the building of the railroads. I know of a small town in Vermont that said it would be worth $100,000 just to hear the whistle of the engine. That was all they ever got from the railroads as another town voted more money for the railroad and the first has to be content with the sound of the whistle as the trains come into the competing towns.

We see the same enthusiastic attitude of the people today in regard to highways. Towns, cities, counties, states and the federal government are voting large sums for the construction and maintenance of our highways.

The same strenuous competition exists between the smaller cities and towns to have one of the main highways such as the Lincoln Highway pass through the town. In fact a study of the building of highways in this country since the World War

shows many of the same characteristics which were associated with the building of railroads.

The highways and the motor car are the great romance of the present day just as the railroad was the great romance during their construction period.

But one great difference exists. Today, we draw upon a vast source of accurate information in the applications of science and engineering and trained men for the job. Then, little in the way of modern machinery existed. The use of high explosives for excavation, of compressed air for driving tunnels and sinking deep foundations were unknown. Concrete as we know it did not exist. Epidemics of disease which medical science had not yet learned to control frequently decimated the construction camps, and as the work proceeded westward the raids of hostile Indians added to the obstacles set by nature.

Between the two periods lie education and the contributions which scientists and engineers have made to civilization.

When James Watt started to build steam engines he first had to make numerous experiments upon the properties of steam and determine whether he should use wood, leather or iron for his piston head. He considered his cylinders good if round within a half inch. Today when the cylinders in your automobile lack 1/1000 of an inch of being round you consider having it rebuilt to a much greater accuracy.

The engineer had an important part in the construction of the railroads. He received little assistance in his work from the aids developed by modern science and invention and he was therefore compelled to rely upon keen powers of observation and a robust common sense. He was a man of simple tastes, of great perseverance, and of tireless energy. The success with which he carried on his work without the mechanical aids of the present day fills us with wonder and awe.

Soon schools and all institutions of learning began more and more to offer specialized courses in the various phases of transportation. Their graduates were thereby enabled to do their part in the transportation industry of the country. Young men of brains plus this special training were able to analyze conditions and to make applications of the discoveries in science and inventions of the time.

Research laboratories were established in most of the schools and colleges and as new problems in transportation arose they were eagerly taken over by the research men and

their solution was sooner or later accomplished and a new material or invention was made the servant of transportation

Thus when it came time to build the modern highways and motor cars there was available a large group of specially trained men, research laboratories in which to study materials and methods, new materials and machines which would produce a part with almost any accuracy desired.

Each new step in the development of the country brings with it new transportation problems. The restriction of immigration has accelerated the development of mechanical means to replace man power. Probably some of you are familiar with the "Ballast-Bug." About the last man you would expect could be replaced by a machine would be the section hand. But the inventive genius of the present day backed by the economic pressure always present seems to have accomplished this, at least in part.

The "Ballast-Bug" is a machine which removes the ballast from between the rails, cleans it, and replaces it without interfering in any way with the operation of trains. It replaces a work train and crew, and a locomotive crane. Its first cost and operation is less than the cost and operation of a crane.

The development of such a machine illustrates how dependent we are upon education and all it implies. Trained men were called upon to design the machine, specialists in various fields such as alloy steels, heat treatment of the material, etc., were all needed to make this a practical working machine.

This illustrates scientific engineering methods of attacking a problem. Contrast this with the experience of the Baltimore and Ohio Railroad when, after experimenting with the "Tom Thumb" which Peter Cooper in 1830 had built, the management of the Railroad offered a prize of $4,000 for a locomotive built in the United States which would haul 15 tons gross weight at 15 miles an hour. I would not imply that all scientifically developed appliances to aid transportation are eagerly accepted by the management. Some times an accident like that at the opening of the Manchester Liverpool Railroad, or that which occurred at the first test of the Westinghouse Airbrake, seems necessary to demonstrate the importance of the invention.

At the time that Westinghouse invented the airbrake, hand braking was laborious as well as hazardous. One brakeman was stationed between every two cars. When about a half mile from the stopping point, each brakeman on a passenger train, would start to turn a wheel on the platform of one of

the cars. This slowly tightened a chain which operated the brakes on a single pair of wheels. When the brakes were set, he would repeat his task on the wheel on the opposite platform. The work was dangerous and the result unsatisfactory for it was impossible to brake the cars with uniformity and avoid bumping them together. On freight trains the danger was even greater.

Westinghouse had developed the airbrake and a train was equipped with them. The train consisted of four cars and the locomotive. In the last car rode the officers of the company and invited guests. The demonstration train drew out of the Panhandle Station and passed slowly through a tunnel. The engineer increased the speed to about 30 miles an hour. Arrangements had been made to keep the crossing clear until the train had passed; so the engineer turned to the mechanism for another inspection. In the instant that his eyes left the road a truckman, thinking that he could beat the engine to the crossing ahead, made a wild dash for the tracks. The engineer's eyes returned to the road just as the frightened horses plunged madly and the driver was hurled in the path of the speeding train. The engineer grasped the brake control and twisted insanely. With a mighty lurch the train stopped dead. Picking themselves from the floor, the passengers in the rear car scrambled to the platform and sprang to the ground. They found the engineer assisting the terror-stricken truckman to arise—four feet from the cowcatcher.

So bruised and ruffled were the witnesses that the significance of the event was slow in dawning. And then they comprehended. In saving a human life, the airbrake had demonstrated its own efficiency. Thus a new invention was added to transportation.

New problems have entered the railroad field. Increase in the size of trains, larger locomotives with stokers, electrification, automatic signals, high speed, traffic control, increased terminal facilities indicate some of the engineering problems which are now pressing the railroads for solution.

The advent of highway transportation with the passenger bus and the freight truck have complicated, or perhaps I had better say, simplified the whole transportation problem. There are in this country only a few scattered instances of door-to-door delivery by railroads which is the common method in England. I predict that the increased traffic congestion in our streets will eventually lead to the elimination of the trucks from

the streets during the day and require that the delivery of frieght to stores, etc., be made during the night. This will tend to cause the railroads to accept the problem of making the delivery, not at the freight house, but to the door of the customer.

Our civilization has become so complex that a variation in any part at once effects all the others. This is especially true in the matter of transportation.

For the solution of these new problems of transportation, we need the trained men. The normal source of such men lies in our colleges and universities. But it is no longer necessary that a man go to college immediately after leaving school in order to secure this special training, although that is probably the quickest, simplest, and best way to secure the training. The demand by men who are working and thus learning in the very best school, the school of life, to secure this special training in whatever field he may be interested, be it science, business, engineering, banking, or in fact, any other field, forced institutions of learning to establish classes in the evening. Such institutions, located in large centers of population such as Pittsburgh, now run classes from 8:30 or 9 in the morning until 10 at night. There are now offered in the evening in this district nearly 500 such courses which are taken by something over 10,000 men and women.

Are the railroads securing their share of trained men? That question, at the present time, must, I think, be answered in the negative. It does not seem that the appeal is as strong as formerly. This may be due to inadequate pay, but probably because the railroads have, during the last two decades, established a reputation, either justly or otherwise, for slow promotions, an excessive apprentice period, and pay which is inadequate to attract a sufficient number of the best men. The successful progress of an industry today can be quite accurately measured by the number of technically trained men whom it employs. So I believe that the railroads must adopt methods to attract and hold such men.

May I quote, in closing, from the poem "The Thinker" by Berton Braley:

Might of the roaring boiler,
    Force of the engine's thrust,
Strength of the sweating toiler,
    Greatly in these we trust;
But back of them stands the Schemer,
    The Thinker who drives things through,
Back of the Job—the Dreamer,
    Who's making the dream come true.

PRESIDENT: Gentlemen, you have heard Dr. Bishop's paper, tracing briefly the history of transportation and the bearing education has upon the same. He has made certain statements and certain deductions, with all of which you may or may not agree. I hope you will feel free to speak your mind this evening one way or the other, for I feel certain that is what the Doctor would like to have done.

DR. BISHOP: That is the only object I had in coming here.

PRESIDENT: I now place the question before you for discussion. Professor Endsley, can you tell us something about this?

PROF. L. E. ENDSLEY: I have known the Dean about twelve years and I can not tell all I think of him or what I do not think of him. But he has given the railroads something to think about on this question of educating their men. No man today makes a success unless he is educated—but he does not have to get it in college. These night schools that are being conducted in connection with the University of Pittsburgh and Carnegie Tech are giving a great many young and middle aged men help in their every day work.

As for educational institutions assisting railroads, I remember at Purdue a great many years ago the seventeenth locomotive super-heater on an engine in the United States was put on a test engine, of the type of today. There were a great many of them used in Canada before they were in the United States. Butler developed at the University of Purdue this superheater of steam for locomotives, and I was told at a meeting at Atlantic City one time where I read a paper on superheated steam, this: I said that before a great many years there would not be an engine built in the United States that did not have a superheater and a Superintendent of Motive Power on one of the

largest lines west said to me, "Professor Endsley, if I believed what you say I would be putting superheaters on fifty engines I am buying today." The next year he came back and said "I have superheated twelve and I wish I had superheated the whole fifty."

Those are some of the things that the colleges did. And they have done a good many other things along other lines, and I do think the railroads are not approaching what the technical man can do for them and I believe some day they will be allowing some of you men to go back to school to get a little more theory. Theory is no good without practice. And here you will make it go when you know your practical end and get a little theory with it. I am sure the Dean's talk tonight has made some of you think. Some of you young men could take a correspondence course or a night course and get a lot out of it. If you pay your $40 and forget all about it you will get nothing out of it for it is especially true here that you will get out of it just about what you put in it. Far be it from me to say that you are not working, but it would be a pleasure to you if you did a little educational work on your own time.

PRESIDENT: Mr. Crawford, may we hear a word from you?

MR. D. F. CRAWFORD: I do not know whether it is entirely fair to have two speakers who belong to the same union. I belong to Dr. Bishop's Society for the Promotion of Engineering Education, and have for many years. This has been a most interesting subject. It is difficult for me to even refer to the subject of education without making some, I hope, modest reference to my own experience. I did not have the opportunity of attending a college and had but little of night school. The night schools that existed long years ago when I was young enough to go to night school, did not teach the technichal things I wanted to know. I am sorry I did not want to know Latin then, for I found out later that I could use it if I knew it. But there is always a field for the man who desires education, I do not care how he gets it. Professor Endsley has referred to joining theory and practice. As a matter of fact in engineering and mechanics there can hardly be a theory without practice. If we see one thing it is an observation. If we see a second, that is another observation. We do not know how to connect the two together. But if we get three points for our curve, we have started our theory, but the first three

points are practice. From those three points we build our theory, and our theory reaches out and gives opportunity for further practice, such as Dr. Bishop has referred to.

In these memorable years of progress that has been made in the development of education, I remember the first installation of an electric lighting plant at Altoona. I was privileged to have one of the cards that told what the divisions on the ampere meter meant. Electricity was a mystery and only the elect were supposed to know amperes and volts We carried little cards in our pockets to tell us. Today such is not the case. There are available in this country and in other countries men who can tackle almost any problem with ample mechanical and experimental data behind them to produce almost anything we want. The airplane is a splendid example of Professor Langley's mathematics. I shall never forget attending a lecture by Professor Langley when he talked in the old brick church on the corner of Wood Street and Sixth Avenue where the McCreery store now stands. He gave a series of lectures, and one was entitled "The Blue Sun." I happened to mention to a friend of mine that I was going to that lecture, and he said, "Well I guess it looks yellow to us because we are green." I remember he described the bolometer, an instrument for measuring the heat of the sun. That man, with his mathematical mind and his observation of the flight of birds, has given us the theory and really the practice on which the airplanes are built.

All these things indicate the desirability of study and education. One can study without a school. Think of the splendid libraries that are available to all of us. Think of the books we can buy, books of all degrees of difficulty or simplicity. We can get books that any of us can understand, I am trying one now that I am just a little afraid of, Mr. Einstein's theory of relativity. It has been said that only twelve men knew anything about relativity and eleven of them are dead. Einstein is still alive, and as Dr. Curtis is, there is some error in that number twelve. I am reading a book on that subject written by one of the dead men: Steinmetz. I am not making much progress and I am not doing it merely out of curiosity, I want to try to realize what the writer is talking about or driving at.

There is all sorts of literature available. The Popular Science Monthly, gives a lot of useful information. While the night schools are desirable and useful, there are other ways of getting education, and one of them is from reading. There is

much literature adapted to each degree of knowledge, whatever it may be, available to all of us both in the libraries and to be purchased for a small price. I would strongly recommend to every one that he read a little bit outside of his work. Read a lot about your work, but read a little outside of it.

PRESIDENT: I notice a gentleman present who has been out of railroading about as long as I have. We would like to hear from Colonel Milliken.

COL. JAMES MILLIKEN: As was brought out in the paper, this is the age of mechanical industry; mechanical science. Industry, science, and progress have to go hand in hand with education. If it were not for the good work of our schools and colleges and universities we would not have a technical man today that could produce the progress the world has seen. There is no doubt that the young man who is able to go to college after he has finished his school days is in better shape to tackle problems than the man that has to go to work. That is no reason, however, why he can not get an education if he wants is. I am very much in sympathy with night classes in colleges. They offer wonderful opportunities for the boys that can not go to college regularly. I think the technical men are the ones for whom the railroads have to be thankful for the many improvements and the wonderful service we are getting on the railroads today.

PRESIDENT: We do not seem to be getting very much of a kick from the railroad men on this subject. You will remember that Dr. Bishop said the railroads were not getting their share of the technically trained men. I would like to have some railroad men tell Dr. Bishop why they are not getting them. Mr. Lynn, what have you to say?

MR. SAMUEL LYNN: I have listened to the Doctor's paper with a great deal of interest with refernce to young men acquiring a technical education and while I have a high regard for what the colleges are doing and feel that the young men of today are much better fitted to go out into the world when they have completed a college course, I sometimes feel that with the competition now existing along all lines of industries, that for a young man to succeed he should have the benefit of a college course. However, I happen to be one of the boys who had to go to work at an early age and what little knowledge I have acquired has been in the college of "hard knocks" and I was

trying to turn over in my mind while the Doctor was presenting his paper, as to what percentage of technically trained men have been employed, not only in railroad shops, but in other departments of railroading, in order to bring about the advancement from the five or ten horsepower locomotive, which he spoke of when steam power was first tried out as a means of transportation, to the monster locomotive of today, and I am wondering if some of the appliances on these modern locomotives and some of the credit for their development, does not belong to men who did not have the benefit of a college education, but received their knowledge in the school of "hard knocks", and by application to their work and by devoting their time to the study of the problems confronting them, they have also contributed to the great progress which has been made. It will be understood that I am not underestimating the value of a college education, however; it seems to me, as has been stated by Mr. Crawford, that if the young men would enter the various railroad shops and take the proper interest in the work assigned them and would use some of the spare moments in the reading of good literature, together with technical books that would help him in his work, while he would probably be a little slower than the man who has the benefit of the college course, nevertheless, this would undoubtedly help the man who has not had the advantages of his more fortunate neighbor. Just recently I was talking to one of our men who has received a diploma from one of our technical schools—his education was acquired by attending night sessions—and he advises me it takes from six to ten years for a student who is going to night school, to get a diploma and while the students are very enthusiastic when they start out, they soon become disheartened and the percentage who actually go through the course is very small. However, the young man who has the backbone and determination to better his condition, and will sacrifice his evening hours and a good time, for a college diploma, there is no question to my mind but what he will get ahead, but I also feel that the man who takes an interest in his work, sticks to his knitting, tries to learn his job, and devotes a portion of his leisure time to good literature and books that will apply direct to his line of work, he too will not fail to get to something worthwhile. The tendency today, as I view it, is that a number of our young people will not take advantage of the opportunities afforded them to prepare themselves for the responsibilities which await them.

PRESIDENT: Are there any volunteers? I believe what is true in industrial plants concerning technical men is also true on railroads. I have been on both sides of the fence. As far as employing technical men is concerned, my experience on various railroads seems to be that one is just about as bad as the other and none are in the position they should be in this respect. There is no question but that the industrial concerns are many laps ahead of the railroads in procuring college trained men for this service. There is a reason for this somewhere. There is a reason why the railroads do not secure technical men like the industrial concerns do. I was hoping to get that question answered by Mr. Lynn. Not being successful in my attempt, I will call on Mr. Farmer, Director of Engineering of the Westinghouse Air Brake Company, who has had a great deal of experience in securing technical men for the Engineering Department of that Company and the methods by which they are procured and retained are interesting, and I believe if the railroads would be as patient as the industrial concerns and coach the young men along in the same way, they might be able to hold more of them. I realize what difficulty it is on railroads to hold technical men. Promotions on railroads are slow, but if railroads would adopt the plan followed by a great many industrial concerns, I believe they would hold more of their men.

MR. C. C. FARMER: I have listened to the paper of the evening with much interest and concur in what Dr. Bishop says about the value to the railroad and industrial organizations of men having a preliminary training in engineering theory for it has been my observation that, every thing else being equal, the man who has had the opportunity to apply himself to the study of engineering theory and secure the resultant mental training, can and will advance more rapidly in his practical work than the man who gets his education in the "university of hard knocks" of which I, like Mr. Crawford, am a graduate.

It follows that, while the university graduate must start his practical work at the bottom, the same as the man not so favored, he can and should in a shorter time be capable of accepting greater responsibilities. This is obviously of distinct advantage to the individual and, in my opinion, of equal advantage to the railroad and industrial organizations who almost invariably have positions to be filled when competent men are available.

I do not mean to imply that I think all the positions are going to be filled by college graduates because there are many men of natural ability having the determination to make good who will devote the necessary time to the study of their problems and make good progress irrespective of the original handicap. Perhaps one of the reasons why the railroads have not secured more of the engineering graduates is that the Westinghouse Air Brake Company has employed as many of them as the organization could absorb.

Speaking of men who secured their education in the so-called "university of hard knocks" reminds me of an incident which occurred on the Siskiyou Mountain of the Southern Pacific Railroad during the winter of 1887 and 1888 shortly after the introduction of automatic brakes on freight trains in which a train crew received a full year's training in the "school of hard knocks" in one night.

While the customary and proper practice is for the locomotive engineer to operate the brakes to stop the train where desired by the train men, a certain local train crew reached the conclusion that they could, by opening the brake pipe at the rear of a train, spot the cars closer to the desired point than could be done by the engineer. This naturally resulted in a train slack action jerk at the engine which was disagreeable and more or less dangerous to the engine men. In an effort to curb the activities of the train crew in this direction, the engineer, who was inclined to practical joking, informed the conductor that by such operation he was taking great chances of breaking the air pump. While this resulted in reducing the frequency of stops from the rear end, it was not fully effective as the train crew again set the brakes from the rear end while stopping the train at Siskiyou Station, the summit of a heavy 17 mile grade, throwing the engineer against and breaking the front cab window. The night was bitter cold and not wishing to sit in the blast coming through the broken window, the engineer closed the pump throttle, disregarded the starting signal, moved to the fireman's side out of the wind and snow and when the conductor came forward to ascertain what was wrong, informed him that, as predicted, they had broken the pump at the stop at Siskiyou and, therefore, the train must be controlled with the hand brakes over the remaining 100 miles of the division, including the 17-mile descending grade. The result was that the engineer was able to keep comfortable while the train crew suffered severely, thus by "hard knocks" ef-

fectually completing their education on this phase of train brake operation. The lack of knowledge of theory underlying the design and operation of brakes permitted this train crew to persist in their improper operating methods and the engineer to get away with his joke.

The development and use of air brakes has been one of the most important elements in the progress of transportation and it may be of special interest in connection with Dr. Bishop's paper to say that at the time of the incident, just related, passenger trains were still being controlled with straight air brakes, necessitating the use on ascending grades of an engine at the rear of the train for the sole purpose of supplying air for applying the brakes and thus preventing cars running back down the grade in case, as some times occurred, the Miller hook couplers were separate unintentionally.

When automatic brakes were later applied to passenger cars, the use of the so-called "safety engine" was discontinued as with automatic brakes each car in the train carries the supply of compressed air for applying its brake, which supply is automatically admitted to the brake cylinder if the train parts and thereby separates the air line couplings between cars.

PRESIDENT: There is a gentleman sitting over here who always has something to say. I never knew him to sidestep. Mr. Anderson, what is the matter with you? Are you not going to talk on this subject?

MR. A. E. ANDERSON: I have a very bad cold tonight. I have been away for some time and this is the first meeting I have attended for quite a while. The first thing I would say is that according to Brother Crawford's statement we should speak to him a word of fond farewell. From what he says he is the thirteenth man on the Einstein jury, eleven of them are already dead, leaving only himself and Mr. Einstein, leaving only himself for Mr. Einstein to come up against. During the lunch hour you had better bid farewell to Mr. Crawford for it is hardly possible that he will survive thirty days more of it.

I would add one item to Dr. Bishop's story of the first railroad construction and the man he referred to, whose name ought to be mentioned. Mr. Huskinson was the Member of Parliament and was the man who put the legislation through Parliament that made the first railroad organization in England. That operation had the modern adaptation in that it required 80,000 Pounds to put that legislation through Parliament.

How that money was spent, these older railroad men can imagine more easily than we in these modern days when economical principles enter into the railroad situation more than they did forty years ago.

On the question of education, and as it was referred to here, college education, there has been a wonderful change in colleges in forty years. The high schools now have better courses than the best colleges had at that time. We hear criticism of men like the men here who have gone through college, that they are not as smart as a lot of the modern people. There is a reason for that, in the measure in which it is true as to technical education. I had occasion today to call on the state employment agency at No. 622 Grant Street and asked the young man what the situation was in regard to employment. The first thing he said was that there are positions open for the very highest grade of technical men, but for the ordinary laboring positions there is nothing doing. Then I said, How about the clerical positions? He said, There is very little doing in that because the high schools are filling up all the clerical positions as fast as they are open. On the question of education, and that means knowledge, there has been a wonderful progress. As several of the speakers have said, with the libraries we have there is no reason why everybody can not have an education. And in getting books out of these libraries, it is quite remarkable the flood of new books coming out on all subjects, bringing you up to date. You can get any quantity of 1925 and 1926 books on all subjects just for going to the library and getting them. So there is no reason why there should not be education along all these lines.

Yet those without formal education in their youth may rightly adopt the position set forth by this story:

A party of gentlemen at their dinner fell into talk on history, leading to which might be thought the oldest nation then in existence. Each had his argument, and when the waiter came in, "and he was Irish too," one said to him: "Pat, we are trying to find out which is the oldest nation now; which one do you say is the oldest?" Pat replied, "Why, Ireland, of course." "Well, that can hardly be, or a couple of them would have been with Noah in the Ark, but the Bible does not say so." "That's easy. At the time of the Flood, Ireland was an independent nation, they had their own boats, and did not need the Ark, or Noah either."

Likewise, the non-college man who gained his learning in

"real life" may think he had his own "boat" and arrived without the formal and often indifferent teachings of his day.

The most remarkable development, which has not been mentioned this evening, on the question of technical training, is the development of the automobile. There are some 22,000,000 passenger automobiles in the world, 80 per cent of which are in the United States, and when you stand on the corner and see the stream of automobiles flow by, running with almost perfect precision, operated by every sort of person from 16 years of age up, men, women, boys and girls, and when you figure that there are very few accidents—although the papers every morning do read in a terribly shocking way, and it does amount to 22,000 deaths in a year, which is very small compared with the number of transactions and the number of miles run by automobiles handled by all sorts of persons—it is truly remarkable the small number of accidents. And to avoid them they are taking more and more precautions, with examinations before granting licenses. And when you figure with every class of people from the ordinary day laborer up to the man who can afford the highest priced car, and all the technical training that is thereby pervading the population of this country and elsewhere, it indicates a most remarkable development. For that very training can be adapted to almost every other line of training and it makes a labor power available in this country for emergencies beyond what we ever dreamed of before.

The question of getting these technical men into railroad service I think is possibly more a matter of competition between the industrial people and the railroad people.

To indicate how recent is this railroad development, it is not ten years since a man died at Cumberland, Md., in the employ of the Baltimore & Ohio Railroad, who at six years of age had been present when Charles Carroll of Carrolton, the last surviving signer of the Declaration of Independence, dedicated corner stone or the monument to the start of the Baltimore & Ohio Railroad, which will celebrate its One Hundredth Anniversary some time next month. So all this development has come along in this comparative short space of years. And about twenty years ago I remember meeting at a lunch table on Third Avenue the mother of a gentleman who had come there every day and he told me she was coming to visit him and that she had been present when five years of age at Manchester with her father when that first train came in on the Liverpool & Manchester Railroad which was referred to by one

of the speakers. So I consider that quite an event, having met that lady. Although she was near ninety years of age, she described with great enthusiasm her impression of that locomotive and train coming in on that first run on that railroad, and the dedication of that new enterprise. George Stephenson was the man who made railroad operation practical, and so far as I know in this country he never has been honored with any monument outside of the railroads themselves. That is a matter that ought to be taken up.

I think the paper was very interesting, and as the Chairman of the Membership Committee said, I get more out of these meetings than from any other organization I attend.

PRESIDENT: I would certainly be remiss if I did not call upon a gentleman I see in the audience, who is an old railroad man, or rather was but is no longer. He is on the other side of the fence, Mr. Wentworth, of The New York Air Brake Company.

MR. E. F. WENTWORTH: Mr. President, I have very little to say on the subject. But I think probably many men here who got their education the way the kid got the small pox, through exposure. Then they started you along the line of promotion they picked you out from probably a hundred others, and you continued to go along in that way by reading good books. About college men, I always think of those "Letters of a Self Made Merchant to his Son," where the old gentleman said "Son, colleges don't make brains, they just polish them. The man that goes to college a fool will come out a fool, but a different kind of a fool." I think the college may cull out the good ones as you go along, and a bigger percentage probably will make good. I believe education and technical training give a man a foundation and an advantage to work on which puts him ahead of the man that starts on the other line. The man that gets his education in the "school of hard knocks" has to work harder to get it, but he can get it in the end just the same.

PRESIDENT: Mr. Anderson mentioned the Baltimore & Ohio celebrating its One Hundredth Anniversary in about a month. I see a gentleman in the audience who is from the Baltimore & Ohio, the Assistant to the Chief of Motive Power and we would like to hear what he has to say, Mr. Kerby.

MR. F. KERBY: I am not a very frequent visitor to this

club but I have heard some very good talks and some very valuable papers read. And I have heard a discussion on practically the same subject we have heard tonight, and in the reading of the paper the history took us back quite a way. I am not very old but nevertheless I can remember some of those old days away back. The Professor spoke about the first train running with air brakes. I was a boy in the seventies when I stood at the Logan House at Altoona and saw an old gentleman and lady looking at the engine with the air brake and listening to the exhaust of the pump, the old lady said, "My, that thing must be tired. Listen how it pants." That may be a story that you have heard before, but it is a fact. I stood there and heard that.

At the present time our young people have a better chance than we who are a little older had to get an education. There is no question that an education is a valuable thing to have. It is a training, it makes you think and it teaches you to think correctly. But that is not all you must do. You must be a go-getter when you get the education in order to get the benefit of it. I remember in the early days when I used to read papers and study books we had a candle with three strands of cotton wicking and a little bit of lard sticking on the wall and we all got around underneath that and studied our lesson, a tallow dip. A candle then was a luxury. The old dipped candle was the usual light. That is the way we got our education. We did not have the opportunities we have today.

I have often thought of what a college education will do for you, along the lines first of the parent who spends the money and invest in an education for the boy and who ought to know what it means and what they can expect of him. Some people think that to educate their boy and get him through college that he can go right out into the world and demand the very best positions and the highest salaries in the country. That is altogether wrong. They must work and build themselves up; in the present day we do not have the opportunity to take the college graduate and place him on the throne. We have other things to think of. We have organizations to tell us what to do. We have to take men as they come up in the ranks, so the man who gets the college education must almost start at the bottom and come up the same as the rest of us did. But his training ought to enable him to come up faster.

The railroad companies of today are doing what the Professor thought out to be done. We are taking men from the high

schools and colleges and placing them in the shops and giving them the technical training and the special preparation. We teach them drawing and mechanics and everything like that We make our foreman out of them. But we do not have enough places to absorb all the college graduates today. For that reason we can not use as many as the colleges turn out.

A little incident that is said to have occurred in the south is worth your thinking over. A blacksmith got the idea that his son George ought to have a college education. So he sent him to college and in due time he came back with a diploma. And the father said "George, what have you learned in college?" He replied, "Father, I have got a very good training, a wonderful education." "Do you know anything about the blacksmith trade?" "Oh yes, we got all that." So the father invited the boy out into the blacksmith shop and said to him "Now I want you to show me what you have learned about blacksmithing." So he put on an apron and picked up a piece of iron and put it in the fire and said "Father, you blow the bellows. Blow it faster and get it hot." And after he got it hot he took it out and he took the light hammer and gave his father the heavy sledge, and they began pounding it down. And the boy says "Faster, father, faster." And the father began to get tired, but the boy kept saying "Faster, faster." Finally the old gentleman said "What in hell are you trying to make any way?" The boy answered, "Keep on pounding, keep on pounding, I think we will make a shovel out of it."

We have men who have advanced by hard knocks, by practical work, some of the very best men in the country today. A peculiar thing happened the other day. We had a foreigner in our country who was very much exercised as to whether the higher officials of the Company were college graduates or not. He asked one of the men what college the president came from He did not have any college education, he was a man who had come up from the ranks. What college did this man come from, naming the next in line. Not any. Then he asked what college this man Kerby came from, and he came from Purdue. I was the only one of the three men at the head of our organization. It must be conceded that if the brain is there and they will put it to work the education is the theoretical or the starting point, still in order to get the benefit of that education there must be will power and you must be a go-getter. You will not get it unless you work for it. You can not expect to rise from the ranks and become one of the higher officials of

the railroad or the industry without going after it and doing the work. The college and even the technical school is a good thing theoretically and good as a starting point. And I think we ought to give it to everybody as far as they can take it. But what ought to be done when we send out young men out of college is to cull them out. Sometimes we have a man who is a good thinker, a man who is adapted to a certain position. When he is turned loose he gets into the wrong place and makes a miserable failure. Why? Because he was not selected for the place he is adapted to fill. And that is one of the things that is pulling down our college graduates today. They are not in every case taught to think that they must work and take the hard knocks as well as the good things if they want to succeed. I have passed through the mill. I started in as a railroad brakeman when I was but a boy and I got my education after I was big enough to earn my own living. I had as good an opportunity to get a good education as any boy in the country but at that time I did not think it was worth while. I did not know that I would need it later on, but after I got to the age where I saw the need of an education I studied at night and in my idle hours instead of running around over the streets. I would take my books and go in a room by myself and study and that is the way I got what little education I have. But I had to work for it. I knew it would not come to me without, I did work for it.

MR. C. N. HOLLINGSWORTH: I can hardly sit still and hear Fred Kerby say what he did without reply. I know him and what he has said is truthful, but he failed to tell you that while he is on the B. & O., that it was the Pennsylvania Railroad, which I represent tonight, that educated him.

I think it is hardly fair for us to sit quiet as railroad men and think that we are not doing our part in taking care of the educated, trained man who comes from the colleges, and that the educated, trained man is not getting his chance on the railroad today. If he is not, it is his own fault. I am in the engineering department and I know that all the fellows who have the proper training from a college standpoint are succeeding and are getting ahead. And at this particular time in the history of the Central Region, where we have about 52,000 men employed, 8 per cent at least are college, technically-trained men. Within the last three months we have promoted in the neighborhood of fifty men, with a constant increase of men

from the colleges. We have not been able to get enough of them to fill up the lower ranks where they must naturally start. If any of you men know of a college graduate, or if you have a son who has a technical education who desires to learn Railroading, let him come to our office and he will likely be given a job. We are insisting, though, on men who have stamina, who have back bone. We want men who can produce and see that other men work. That is essential in the railroad game. That may be one of the reasons why the industries can get these fellows and we can not. We are insisting on them working.

I am going to tell you that we are getting about 95 per cent efficiency out of the men. Fred, how are you making out?

MR. KERBY: About the same.

MR. HOLLINGSWORTH: I don't believe the B. & O. is quite as good.

MR. KERBY: I wish to correct my statement. The Baltimore & Ohio is about one per cent better than 95.

MR. HOLLINGSWORTH: We are running at 100 per cent.

PRESIDENT: Dr. Bishop, you have heard the general discussion. Would you like to have a closing word?

DR. BISHOP: I never heard a group of men get up on their feet and say something so quietly and with so few words and do it right. I was particularly interested in one speaker as to the selection of men. It has been said that a college is not so much an educational institution as a selective device for eliminating undesirables. You know there is quite a good deal in that theory especially as applying to a Freshman class entering any college in the United States today. Let me tell it to you as it was told at Purdue on the morning that the Freshman Class met for the first time. The Dean said, "Now gentlemen, take a good look at your neighbor, so you will know him." They all looked in astonishment. Some one said "Why?" "Because he will not be here next year." Then he said "I want you to look at the man on the other side of you and take a good look at him. I want you to get acquainted with him." Again some one said "Why?" "Because he will not graduate." In other words, one out of every three, or 28 per cent of the students entering the Freshman Class in an Engineering School,

graduates. That is a pretty good selective organization, and is perhaps one of the very best functions which the colleges can perform.

I would like to say another thing about modern education. For a great many years the colleges failed to take into account the fact that the "College of Hard Knocks" is just as valuable to the educational institution as the class room is to the college, and therefore in many institutions, like the University of Pittsburgh, they require before a man becomes an engineer, that he spend at least twelve months in some industry so he can obtain a little idea of what he is going to get, after he graduates; and if a man fails in his "School of Hard Knocks" he is dropped from the University because we believe he will not make a desirable man in the Engineering field.

PRESIDENT: The hour is growing late and it is about time to close.

MR. D. F. CRAWFORD: Before closing, I would like to thank Mr. Anderson for his kind words of sympathy and farewell. But do not expect to understand the Einstein theory, therefore I have good chances for living.

While I am on my feet, I would like to move that we extend a vote of thanks to Dr. Bishop for his very interesting paper.

The motion was duly seconded and prevailed by unanimous rising vote.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

OFFICIAL PROCEEDINGS
RAILWAY CLUB OF PITTSBURGH
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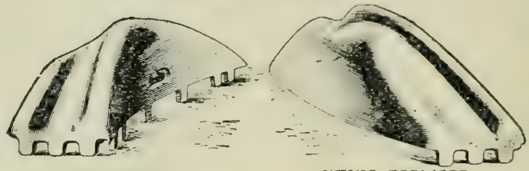

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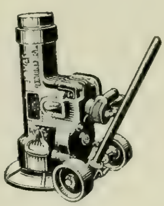

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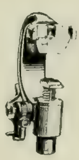

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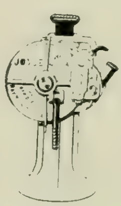

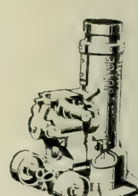

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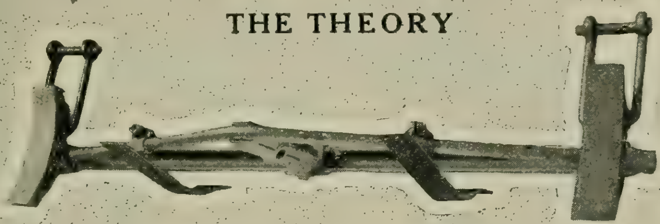

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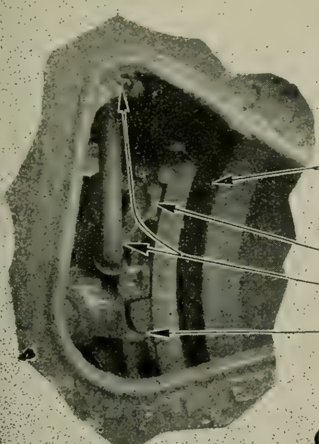

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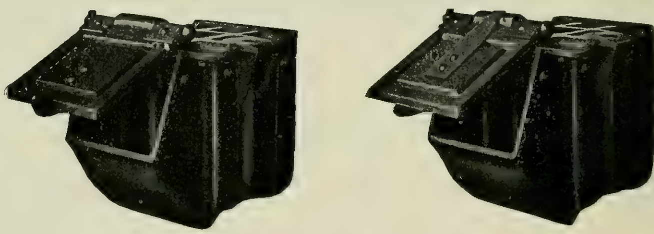

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*H. W. WATTS....November, 1907, to April, 1908
D. J. REDDING....November, 1908, to October, 1910
*F. R. McFEATTERS....November, 1910, to October, 1912
A. G. MITCHELL....November, 1912, to October, 1914
*F. M. McNULTY....November, 1914, to October, 1916
J. G. CODE....November, 1916, to October, 1917
*D. M. HOWE....November, 1917, to October, 1918
J. A. SPIELMANN....November, 1918, to October, 1919
H. H. MAXFIELD....November, 1919, to October, 1920
FRANK J. LANAHAN....November, 1920, to October, 1921
SAMUEL LYNN....November, 1921, to October, 1922
D. F. CRAWFORD....November, 1922, to October, 1923
GEORGE D. OGDEN....November, 1923, to October, 1924
A. STUCKI....November, 1924, to October, 1925
F. G. MINNICK....November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

FEBRUARY 24, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8:00 o'clock p. m., President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, L.
Adams, W. A.
Ainsworth, J. H.
Allen, Harvey
Allison, John
Altsman, W. H.
Ambrose, W. F.
Anderson, A. E.
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Babcock, F. H.
Ball, Fred M.
Barrett, R. L.
Beam, E. J.
Bernoulli, W. H.
Boiselle, R.
Boyle, E A.
Brueckner, A. J.
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Campbell, J. T.
Cannon, T. E.
Champion, James H.
Conway, J. D.
Cotter, George L.
Crawford, D. F.
Crawford, G. M.
Crenner, J. A.
Croft, C A.
Cromwell, H. L.
Dalzell, W. E.
Dambach, C. O.
Davis, Charles S.
Dampsey, P. W.
Downes, J. R.
Edwards, C. H.
Emery, E.
EnDine, J. F.
Endsley, Louis E.
Falkner, A. J.
Farrell, G. R.
Fendner, W. J.
Fenton, H. H.
Fike, James W.
Fults, J. H.
Geddes, D. Y.
Geisler, J. J.
Gibson, D. W.
Gilg, Henry F.
Goda, P. H.
Goff, J. P.
Gordon, George A.
Greene, W. F.
Grieve, Robert E.
Grossheim, E. C.
Guignon, W. E.
Hackett, C. M.
Hale, O. R.
Haller, Nelson M.
Hamilton, William
Hansen, W. C.
Harter, Arnold
Haskell, B
Heinlein, George J.
Henry, C. L.
Hickling, F. G.
Hoffman, C. T.
Holmes, E. A.
Hoover, J. W.
Howard, L. F.
Howe, Harry
Huber, H. G.
Hughes, John E.
Hunter, B. E.
Johnston, W. A.
Karns, C. A.
Kelly, H. W.
Kelly, J. P.
Kroske, J. F.
Kummer, Joseph H.
Laughner, C. L.
Lawson, A. F.
Lehr, Harry W.
Lewis, Herbert

Lewis, Walter M.
Lobez, P. L.
Lohr, A. W.
Loughner, George D.
Luddy, W. E.
Lyman, L. S.
Maloney, J. J.
Mason, S. O.
Merscher, John
Mertz, G. H.
Millar, C. W.
Miller, J.
Mitchell, F. K.
Mitchell, W. S.
Moir, W. B.
Moore, Donald O.
Morris, J. H.
Moses, G. L.
Muir, R. Y.
Mundy, F. I.
Myers, T. P.
McCune, J. O.
McGann, J. F.
McGregor, D. C.
McLaughlin, H. B.
McVay, W. H.
Nelson, R. F.
Noble, J. A.
Nutt, H. C.
O'Connor, M. J.
Oppermann, E. W.
Orchard, Charles
Palmer, E. A.
Passmore, H. E.
Peoples, J. S.
Perkins, Charles F.
Perry, W. E.
Peterson, E. J.
Pickels, H. .D
Posteraro, S. F.
Provost, S. W.
Purnell, C. S.
Rauschart, E. A.
Read, A. A.
Reardon, M. J.
Reckley, A. P.
Reddick, Warren E.
Reese, O. P.
Richardson, H. R.
Rogers, Robert
Shellenbarger, H. M.
Sheridan, T. F.
Simon, Philip
Smith, H. K.
Smith, R. W.
Stebler, W. J.
Strachan, M. B.
Strohmer, J. L.
Stucki, A.
Sutherland, L.
Tucker, J. L.
Warner, E. O.
Warren, A. T.
Weissert, W. J.
Wessel, Harry G.
Wheatley, William
White, A. S.
Whiter, E. T.
Whitlock, C. E.
Wikander, O. R.
Wildin, G. W.
Wood, E. H.
Wright, John B.
Wright, O. L.
Wyke, J. W.
Wynn, M. E.
Wynne, F. E.
Young, F. C.
Zeher, W. G.

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Bard, F. N.
Berner, John A.
Braun, L. H.
Brown, Homer
Carlson, L. E.
Davis, William B.
Deevers, D. F.
Fisher, Earl H.
Gaskin, Paul
Hastings, Walter S.
Howener, A. S.
Hume, John
Jackson, C. T.
Klassen, Fred G.
Lewis, S. B.
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Mogan, John M.

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McConnell, A. L.	Stenson, George A.
McKee, Thomas J.	Strachan, James M.
McLaughlin, J. P.	Talbot, R. A.
McLaughlin, T. J.	Thiele, Fred
McNamee, W.	Trust, J. F.
Neib, H. A., Jr.	Updegraff, R. H.
Schmidt, G. A.	White, Robert H.
Shelly, D. L.	Williams, A. G.
Smith, Sion B.	Yetso, John J.

The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Anne, George E., Representative, American Brake Shoe & Foundry Company, Altoona, Pa. Recommended by Robert Rogers.

Braun, L. H., Planner-Passenger Car Department, Pressed Steel Car Company, 256 Beringer Place, Bellevue, Pa. Recommended by C. L. Laughner.

Brunner, Carl H., Representative, The Joyce-Cridland Company, 609 Avery Street, N. S., Pittsburgh, Pa. Recommended by J. D. Conway.

Gibson, P. B., Renewal Parts Sec. Head, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Recommended by A. P. Schrader.

Greb, Ralph H., Renewal Parts Engineer, Westinghouse Electric & Manufacturing Company, 7339 McClure Avenue, Swissvale, Pa. Recommended by C. L. Painter.

Holleran, Thomas J., Engineer, Monongahela Connecting Railroad, West Homestead, Pa. Recommended by J. R. Geddes.

Householder, J. A., Foreman, Westinghouse Air Brake Company, Madison Avenue, Irwin, Pa. Recommended by G. W. Wildin.

Klassen, Fred G., Gang Foreman, P. & W. Va. Ry., 27 Oakwood Road, Crafton, Pittsburgh, Pa. Recommended by T. E. Cannon.

Matheny, George W., Yard Conductor, P. & L. E. R. R., 1808 Jenny Lind Street, McKeesport, Pa. Recommended by J. W. McElravy.

Maxwell, R. E., Sales Engineer, Carnegie Steel Company, Car-

negie Building, Pittsburgh, Pa. Recommended by Charles Orchard.

Miller, J. F., Sales Engineer, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pa. Recommended by Charles Orchard.

Mogan, John M., General Yardmaster, P. & L. E. R. R., 121 Overbrook Boulevard, Pittsburgh, Pa. Recommended by J. W. McElravy.

McConnell, Allen L., Car Distributor, P. & L. E. R. R., 127 Fitler Street, Pittsburgh, Pa. Recommended by A. P. Reckley.

McCreanor, R. J., Renewal Parts Engineering, Westinghouse Electric & Manufacturing Co., 175 Lloyd Avenue, Edgewood, Pittsburgh, Pa. Recommended by C. L. Painter.

McKelvey, J. E., Asst. General Manager Sales, Neely Nut & Bolt Company, Twenty-first and Wharton Streets, Pittsburgh, Pa. Recommended by R. A. Lackner.

McNamee, William W., Superintendent, Briggs & Turivas Company, 175 South Linwood Avenue, Crafton, Pa. Recommended by E. A. Rauschart.

McQuillen, J. J., President, Universal Packing Corporation, 108 Smithfield Street, Pittsburgh, Pa. Recommended by Herbert Lewis.

Oppermann, E. W., Engineer in Test Department, Westinghouse Air Brake Co., 1109 South Avenue, Wilkinsburg, Pa. Recommended by G. W. Wildin.

Record, J. Fred, Superintendent of Production, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

Rowles, L. L., Foreman Department "N," Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

Smith, C. G., Supt. Transportation, Wheeling Steel Corporation, Steubenville, Ohio. Recommended by J. T. Brennan.

Strachan, J. M., Shipper, Jones & Laughlin Steel Corporation, 2805 Strachan Avenue, Dormont, Pa. Recommended by M. B. Strachan.

Talbot, R. A., President and Treasurer, Talbot Manufacturing Company, 151 Georgia Avenue, Providence, R. I.

Thiele, Fred, Sr., Asst. General Yard Master, P. & L. E. R. R., McKees Rocks, Pa. Recommended by L. Sutherland.

Thurston, H. B., Vice President, The Talmage Manufacturing

Company, 1279 West Third Street, Cleveland, Ohio. Recommended by Herbert Lewis.

Van Ryn, William, Asst. Foreman Department D. M., Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

White, Robert H., Gang Foreman, P. & W. Va. Ry., 2416 Durbin Street, Crafton, Pittsburgh, Pa. Recommended by T. E. Cannon.

Williams, A. G., Car Foreman, P. & W. Va. Ry., 3044 Norland Street, Carnegie, Pa. Recommended by T. E. Cannon.

Work, B. J., Yard Master, McKeesport Tin Plate Company, 632 West Fifth Avenue, McKeesport, Pa. Recommended by J. W. McElravy.

Wright, Harry C., Conductor, Mon. Con. R. R., 5766 Baum Boulevard, Pittsburgh, Pa. Recommended by J. R. Geddes.

PRESIDENT: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action than the payment of the current year's dues.

The Secretary announced the death of five members of the Club, reported since the last meeting, as follows:

NAME	DIED
Frank I. Ellis,	January 16, 1927
J. V. Styers,	January 28, 1927
L. E. Osborne,	January 30, 1927
William S. Gibson,	February 2, 1927
William F. Ryan,	February 9, 1927

PRESIDENT: Approprite memorial will appear in the Official Proceedings of the Club.

Is there anything else Mr. Secretary to be brought before the meeting at this time? If not, this brings us to the paper of the evening. We have with us as our speaker a gentleman who needs no introduction from me. He has come up in the railroad world through the school of hard knocks and has reached the eminent position of Regional Vice President of the Pennsylvania Railroad. We are indeed fortunate in having him with us at this time to address us. I am sure there is a treat in store for all who are here tonight

I take pleasure in introducing Mr. E. T. Whiter, Regional Vice President of the Pennsylvania Railroad, who will address us on the subject "Current Railroad Affairs."

CURRENT RAILROAD AFFAIRS

By E. T. WHITER, Vice President,

Central Region Pennsylvania Railroad, Pittsburgh, Pa.

Mr. Chairman and Gentlemen: I believe it is always customary before you make an address to tell everybody how happy you are to be here. It reminds me of Mr. Dooley, a character created by Mr. Finley Peter Dunne some years ago, which was very popular at that time. Mr. Dooley, when called upon to make a speech, got up and said "As individuals you are my friends; collectively you are my enemies." I do not feel that way here. I feel rather that I am among friends, because I am a member of this organization, although unfortunately I have not been able to be present at very many of its meetings.

The situation on the railroads at the end of the period of Federal Control was somewhat different from what it is today.

The railroads have entered upon a period quite different to any that has prevailed in more than a decade. They find themselves able to handle a great deal more business than is being offered them. For the first time in a good many years railroad managements are at comparative ease regarding the supply of serviceable locomotives and cars. For more than four years railroad managements have made very strenuous efforts and very heavy expenditures to catch up with increasing demands for both freight and passenger service. The element of emergency, such as existed over the greater part of the past four years, has practically faded out of the picture. We have come to calmer days, and we should turn out a better job of railroading than has ever been done.

Our immediate problem is to operate an enlarged transportation plant, with correspondingly increased overhead, and operating at less than capacity, and at the same time make such a satisfactory showing in net earnings that railroad credit will not be impaired. I mention credit as being predominantly vital because credit or the lack of it will regulate the rate at which we shall be able to continue our program of modernizing and bettering our railroad facilities and operations.

In our favor we have three highly important factors that were lacking at other critical periods in railroad history.

We have a much better informed and more sympathetic

public. We have a welcome place at the table occupied by the American economic family.

We are not regarded as outsiders or as maintaining ourselves in a state of more or less isolated defense. We have great bodies of shippers, organized as advisory boards, who know and appreciate our problems and who have not hesitated very largely to make our problems their own, and to let us make their related problems our own. On this basis, patrons and carriers alike have been getting somewhere. They have opened up a wide field of mutually beneficial, systematized, friendly dealings that promises annually larger gains for the nation.

I do not hesitate to say that had there been such an organization of informed railroad patrons back in the days when **regulation** was turning into **repression,** we might have avoided two black decades of "sick railroads" and the paralyzing effect frightfully inadequate transportation had on the nation's industrial life. In the light of business expansion and the growth of national wealth under the few recent years of superior railroad operation, one is privileged to believe that governmental repression prior to the war period kept America from developing as the country otherwise would have, and also left us a legacy of railroad inefficiencies from the effects of which we are not yet wholly free.

A second great factor in favor of the railroads at this time is the existence of the Transportation Act, by the principles of which the people have been enabled to more nearly do justice to their transportation system and the railroads have approached prosperity. Events have proved this law was a definite step in the right direction. After seven years of practical application, the law is found to be sound in its major premise, namely, that the government has a duty to perform toward the railways as well as toward those who use the railways.

The next logical step dictated by wisdom is to make the percentage of earnings permitted by the law conform to seemingly well established, reasonable percentages enjoyed by other American economic groups. I have never been able to see fairness in the doctrine which holds that money put into a company performing a public service shall be handicapped all out of reason in favor of money invested in enterprises for private service. In effect, there is no economic difference in the two sets of services, each contributes to a common prosperity, they even labor in unison and their efforts are becoming syn-

chronized. Is it too much to ask that eventually the dollar free for investment will be let to flow into sound railroad common stock issues under as favorable and encouraging conditions as they now flow into other long-established, well-managed private enterprises whose products are and must be distributed by the railroads?

Back in 1920 when debate was had on how much the railroads should be permitted to earn and retain, a legal limit of 5½ per cent was written into the law, which two years later was increased to 5¾ per cent Theoretically, that figure may seem to be all right, but seven years of experience apparently proves the figure is too low. The limit has operated prejudicially to the railroads. It has rendered rail securities unattractive to the great mass of people who have money to invest. Yet, eventually, we shall have to appeal to these people and get them to invest in railroad stocks. If they have refused pretty generally for seven years to become partners in the transportation industry because permissible earnings are too meager, it seems to me that it is high time to recognize the fact and take remedial steps. It is possible to do this without disturbing the Transportation Act in its basic aspects.

I regret in recent months a recurrence in some quarters of the feeling that railroad securities are speculative in nature. This is basically untrue. Railroad shares are primarily investments and all sensible people so regard them.

The recent rise in market prices of standard railroad stocks has been due a dozen times more to a fuller realization of their soundness as investments than to their possibilities as short term speculations. The abrupt and publicly inexplicable jumps in market quotations made by some railroad stocks are due to movements possibly presaging consolidations. At this time, however, consolidation projects face many "ifs", including grave doubts as to their universal expediency.

From the viewpoint of the investor in standard railroad stocks, there may be something attractive in the thought that a general consolidation scheme bringing all railroad properties within a few large systems will be tantamount to excluding any new railroad corporations and thereby vest existing railways with exclusive, though competing, rights. Under such circumstances the shares of strong standard railroads whose common stock issues represent only a fraction of the value of their property employed for rate-making purposes, might prove to be especially desirable investments. At any rate, the pros-

pects involved in consolidation cause no anxiety to holders of Pennsylvania Railroad stock. The Pennsylvania Railroad has a central, strategic location and no amount of scheming or combining will appreciably lessen the increasing demand made on it as a public carrier.

In considering ways to make railroad shares as attractive investment as private company shares, and in figuring on the prospects involved in consolidations, one should not lose sight of the fact that these advances have been brought within the range of possibilities by the adoption and administration the past seven years of this new basic railroad code, the Transportation Act. If this law is not all we think it should be, at least we must acknowledge it is the best in 40 years and far more workable on a large scale than any of its predecessors. This law, in essential features, assures substantial railroad integrity for quite a period in our future.

In the state of railroad labor is found a third encouraging feature of our current railroad assurance against undesirable developments on this important score. To many people, the fact of wage increases may appear to be the principal accomplishment of the Watson-Parker Law. Wage increases, however, are but an incident in comparison to the real accomplishment. Suppose that under this law there has to come a wage decrease, dictated by circumstances and conditions as strong as those which have brought about wage increases. What would surface enthusiasts then say? In the labor law, not yet a year old, chief value is found in the means and manner of carrying on wage negotiations and hearings, rather than in the terms of the decisions arrived at. The significant fact is that for the first time, on a major scale, railroad management and railroad labor are peacefully and successfully acting in concert, in accordance with a plan devised by them, in keeping their own house in order. If this isn't a milestone in America's history of employer-employe relations, then I don't know anything about labor milestones. A feeling on the part of employes that they can and do get justice in mutual dealings with employers is a condition precedent to the effective operation of a railroad.

Speaking for the Pennsylvania in particular, I feel justified in saying that we have attained very splendid labor relations. The only unfortunate feature comes in instances where the falling off in business compels us to reduce forces temporarily. On the whole, though, I think progress has been made toward

stabilizing employment. The next few years ought to see even more accomplished along this line. I have no fear of communistic complications and regard socialism as a dying issue. In good time the passing of the soap box orator may be follwed by the passing of the demagogue from political halls. An agrarian population may need the stimulus of demagoguery, merely to vary the monotony, but the lives led by people in the industrialized sections of the country are so delicately adjusted to a day-to-day regularity that they cannot afford to indulge their emotions to the extent they once did. Labor troubles are coming to be viewd in the same light as luxuries, the most of them being too expensive for ordinary people to fool with. There is a growing amount of common-sense in the country.

In a general way, business conditions in this country promise to continue on a pretty normal trend. The time is unusually favorable for thoughtful research. We must keep our engineering forces busy providing better road facilities, especially in the art of signaling and train operation. Other sets of engineers and scientists are giving us more perfect types of locomotives and cars. A third set of research men have taken up the question of getting more work out of these increasingly bettered facilities and rolling stock. Their most promising problem is that of loading cars heavier.

For a great many years we have gone along talking about loading cars heavier, but in spite of all our talk the loads have not on the average become heavier. The cars have been made bigger, but at the same time the number of lightly loaded cars has increased and the mileage of empty cars has grown. So, after looking over the figures and finding that our ability to haul more freight per day is due to our ability to move it faster, rather than to loading cars heavier, a systematic study of heavier car loading is to be made. The Atlantic States Shippers Advisory Board has taken the lead in this matter. The need for such a study is nationwide and the remedy does not lie wholly within the efforts of railroad men alone. By mutual effort and very extensive planning, covering a period of years, we will have to work out new schemes for getting bigger loads into cars now carrying only a fraction of their capacity and at the same time cut down the mileage made by empties.

We should all understand, when we consider matters of this character, that the total cost of maintaining the railroads

as transportation agencies is a tax upon the common pocketbook and enters into every family's budget. Therefore, people outside the railroad world as well as those in it have good reason to applaud the reduction of ton-mile railroad operating costs. We cannot continue reducing railroad rates except as we are able to cut costs of handling the business.

Very similar logic may be applied to the question of passenger bus and motor truck competition. Where these added transportation facilities tend to cut heavily into railroad revenue, they simply increase the nation's annual bill for transportation. This comes about through the fact that the railroad organization has to be maintained pretty much as though regular business was being done. The railroad's overhead expenses continue practically as before.

Under the law the railroad must continue to perform service, even at a loss, while the motor bus can discontinue service at will.

Where there is a plain duplication of service, one by the railroad and one by motor lines, the public bears the expense of keeping up both of them. The problem is largely new and when the public eventually appreciates the economic absurdities that are involved, proper action will be taken, no doubt.

PRESIDENT: Gentlemen, you have just listened to a splendid address. We have a very representative body of men here this evening, one of the largest meetings we have had for some time, and I hope you will take it upon yourselves to discuss the topics that have been brought up by Mr. Whiter. And I have no doubt he will be perfectly willing to cross swords with you on any angle of a discussion you may wish to start.

MR. WHITER: To the best of my ability.

PRESIDENT: I will now throw the subject open to volunteers who may wish to discuss the paper. If you do not discuss it voluntarily, I will have to draft some of you in order to get action.

MR. WHITER: If I might add just one more thought in connection with the outlook for business, the year 1926 was one of the greatest years for business that we have had. That is particularly true of the railroads. We have been encouraged to believe that the same conditions are going to continue through 1927, or at least through a large part of 1927. During the month of January the business of the railroads was not up to the same level that it was a year ago in January. The same is true, we might say, for the first half of February. There

are good indications now, however, of business coming back. The steel industries are still optimistic and believe that business is going to come back. Certainly there is no overproduction at this time. And we have been living a hand to mouth existence. The big concerns that used to order lots of goods, instead of stocking up for six months or a year and carrying a very large inventory, are ordering only two or three weeks in advance. That has been brought about largely by the efficient operation of the railroads during the past three or four years. The shipping public have come to have confidence in the ability of the railroads to perform the service, with the result that millions of dollars that were tied up in inventories in the past have been released for the expansion of business and for other purposes.

There has also been developed in this country a wonderful business of paying for things periodically. People buy on credit, a dollar down and a dollar a week, as the song goes. Through that, and with plenty of labor at good wages, there is much more money thrown on the market for the purchase of all kinds of articles, and thousands and thousands of people have been buying on the installment plan. There has been some question as to what is going to be the result of that, whether in the end it will not result in a lot of failures in a business way. But one large concern that has been following the subject closely, and which itself was selling automobiles largely on the installment plan, have developed the fact that out of $2,000,000,000 worth of business in the past ten years sold on the installment plan, there has only been a loss of 1/8 of 1 per cent. That is remarkable, and is an indication of conditions in this country. It seems to me, that there is no danger or fear of any slump or any hard times in the near future. This is, I think, also further proved by the fact that there is no overproduction in the country at this time. I do not see how there can possibly be anything other than a prosperous year for 1927.

PRESIDENT: Volunteers do not seem to be flocking to the front. There is one individual with us who is always willing to start things when called upon. I am going to call on Professor Endsley.

PROF. L. E. ENDSLEY: I am glad to be here and to have had the opportunity of listening to Mr. Whiter. You know I was raised out in Indiana, where the farmers thought the railroads would never do any good, and where if a cow

was killed it was always registered stock and very valuable. Farmer juries decided against the railroads always. I believe that time has gone by. I believe the people of the United States today appreciate what the railroads have done for this country, and I think this is largely due to the railroads. They used to take the peoples money and say nothing, while today they work with the manufacturer and publish what they have really done for this country. There are only three things that we can really enjoy in this world, food, clothing and seeing something. And the railroads help us today in obtaining all three of these.

We really must take this problem to heart. If we can get a car out of our yards a day earlier that means a car more for somebody else. I heard a man say the other day "How much demurrage have you on that car?" When he was told, he said, "We ought not to have had that demurrage." "Why didn't you unload it?" "I could not unload it, I did not have any place to put it." He simply did not have the facilities in his own yard to take care of his own business

I am glad that a man of the caliber of Mr. Whiter has come out to tell us what the railroads are doing. Twenty years ago a man in his job would not have told us anything. It is too bad that the public as a whole could not have heard this talk.

PRESIDENT: Mr. Dambach, General Superintendent of the Pittsburgh & West Virginia Railroad, may we not hear from you?

MR. C. O. DAMBACH: You were going to call on volunteers. I did not volunteer.

PRESIDENT: I told you what you would get if you did not volunteer.

MR. DAMBACH: I enjoyed the paper very much, but I think the ground was covered so thoroughly by Mr. Whiter that any remarks from me would be out of order. I hope you will excuse me tonight.

PRESIDENT: I am going to try to mix this up a little. I am going to call on Mr. Anderson.

MR A. E. ANDERSON: I was just waiting to volunteer. You have spoiled a volunteer discussion.

I think we are indebted to Mr. Whiter for this comprehensive statement. The strongest impression I gained from it was that with this modern spirit that has come up since the Transportation Act was passed, if that had been in existence on the part of railroad managers forty years ago there would

not have been any necessity for the passage of the Interstate Commerce Act, which has been one of the most expensive experiments in the attempt of government to control business; we have ever had. We would not have had as a sequence of that Act the great experiment of the valuation of railroads which has been going on for more than ten years and is not completed yet; according to the decision of the Supreme Court a few days ago it will not be ended for ten or fifteen or twenty years more, because the substance of that decision was that although these valuations have been made, they cannot be disturbed by the railroads until the Interstate Commerce Commission undertakes to put these valuations in force in the course of attempting to make a rate for the railroad, and you can very easily see what a source of litigation there eventually will be on that. So that, as Professor Endsley referred to, if the railroad managers had been wise in their day a good many years ago, there would not have been this attitude of hostility on the part of the public which was brought about by concealment of what they were doing more than anything else.

On Monday the 28th of February will be celebrated the 100th Anniversary of the granting of the charter to the Baltimore & Ohio Railroad. There is to be a celebration by the local people, I believe. That shows the length of time it takes for our development and progress. One hundred years from the time of the beginning of the railroad enterprise in the United States we are listening to this address by Mr. Whiter which shows a modern up to date development of business on the part of the railroads. He is a missionary for the railroads and I wonder when he is ever at home, for every time I pick up a paper I read that he is off making an address some place else, and I often wonder how he finds time to run the Central Region of the Pennsylvania Railroad. For years I have urged the members of this Club to get out, and tell the people their daily experience, what they have to do in carrying on this transportation machine. That very spirit is what is leading in the formation of these Shippers' Advisory Committees, and it is reflected in the broad minded attitude of labor in the recent settlement under the Watson-Parker Act. It shows what can be done with men with their minds open to reach a conclusion. So it is a remarkable development, because it was from 1827 to 1861 before the local branch of the Baltimore & Ohio Railroad was built into Pittsburgh, and the main line could have come directly into Pittsburgh if had not been for the opposition

at that time trying to keep them out of the state of Pennsylvania. Instead the Baltimore and Ohio was built down to Wheeling in another state.

Coming down to the address, the miracle of the last year's business to me was to watch the announcement from week to week of a million or more carloads loaded in that week. It is a miracle compared with ten years ago. But it is a greater miracle when you consider that within ten years we have had the development of the automobile, both for passenger service and bus service as well as the truck service for freight. That is an incident in the railroad business. And yet with all that competition the railroads have kept up their end and handled a greater volume of business than they ever did before. If it had not been for that competition I doubt whether they could have handled the business as well as they have. I would like to have Mr. Whiter give us an explanation of that phase of this automobile development.

I believe, Mr. Chairman, that covers enough of your time so that you have room left for other volunteer remarks, if you do not interfere with their volunteering.

MR. WHITER: There is at least one explanation of the question Mr. Anderson has propounded. I wish to say that the bus competition with the railroads has largely reduced the number of local passengers. It has not materially affected the long haul passenger business, but it has depleted the passenger business on branch lines and on local train service running forty or fifty miles. Those busses have taken practically all the railroad business of that nature, yet the railroads can not discontinue that service without the permission of the various state commissions. We have been only indifferently successful in convincing some of the state commissions that we ought to be permitted to take off some of that mileage, and that is what I referred to when I said the public had to pay for duplicate service. As far as loss in freight traffic is concerned, that is also on short haul business. Some of the railroads, the Pennsylvania among others, have contracted with people who are operating motor trucks to handle local traffic for them. It is collected at intermediate points and delivered at central points where the railroads consolidate it into carload business and are thus able to reduce delays to through trains due to local freight trains occupying the main tracks working at intermediate stations.

That has benefitted the railroads to a certain extent. On

the other hand the passenger bus business has hurt the railroad business. We hope in time, that with proper regulation by the various state commissions or the Interstate Commerce Commission as to where the motor busses and trucks shall operate and where they shall not be operated, it will at least be beneficial to the public at large. For there is nothing but loss in the duplication of service when adequate service is already accorded. All this duplication, as I stated in my paper, is paid for by the public.

MR. ANDERSON: Do you have any long haul truck competition to amount to anything?

MR. WHITER: No long haul truck competition.

PRESIDENT: We have with us Mr. J. E. Hughes, Superintendent P. & L. E. R. R., we would like to hear from him.

MR. HUGHES: I do not think I have anything to say in addition to what has already been said by Mr. Whiter.

MR. D. O. MOORE (Chamber of Commerce): I will be one of the volunteers. No one has said anything about the transportation involved in bringing our food to us, and that is a considerable item. Our wives go to market in the morning with their baskets, but they do not inquire how the stuff gets there. It reminds me of a little poem I read once, written by a preacher, that ran something like this.

> Back of the loaf is the snowy flour
>   Back of the flour is the mill
> Back of the Mill is the wheat and shower
>   And the sun and the Fathers will.

I believe the preacher could have added a verse bringing in the transportation service to get the wheat from the farm to the mill and from the mill to the market. We are all affected by the transportation service and the distribution of the products of our mines and factories and which most of the community is dependent upon. If it were not for continuous transportation service there would be a shut down of these mills and the employes would suffer as they would not have the money to send their wives to market with.

PRESIDENT: Mr. Geddes, Superintendent, P. R. R., is in the audience we would like to hear from him.

MR. D. Y. GEDDES: It hardly behooves a superintendent of the Pennsylvania Railroad to talk against his vice president.

PRESIDENT: This is the only place you can do it without being called down.

MR. GEDDES: There is one point in connection with Mr. Whiter's remarks which has been carried through the newspapers recently and that is the comparison of the tax rate and the dividend rate. The tax rate is heavier than the dividend rate. And if you will have noticed some of the recent articles, there was a gentleman in Baltimore started a Ku Klux Klan idea against the tax rate and he has been quite successful. The tax rate in Baltimore has increased in the last forty years until last year. They have now started to decrease. The taxes on railroads are a very serious load and I would like very much if Mr. Whiter would give us some information on that point.

M. WHITER: The taxes paid by the railroads of the United States average a million dollars a day. In 1924 they ran $300,000,000, in 1925 $350,000,000 and they are now running at the rate of almost $1,000,000 a day and they probably will go above that figure in 1927 because the tendency is upward.

In that connection there is one thought about government ownership that people have not considered. The government pays no taxes. If the government should ever take over the railroads of this country that amount of money has got to be made up from some source, because it will require money to operate the railroads and the only way it can be made up is through increased taxes or increased rates which the people will pay.

PRESIDENT: We have with us Mr. Gibson, Superintendent of the American Railway Express. We would be glad to hear from Mr. Gibson.

MR. D. W. GIBSON: I had thought I was glad to be here and was enjoying myself in being a listener. But I do not know that I am just at the present time.

Not being a volunteer do not know that I can add anything to what has been said. I have enjoyed the remarks of Mr. Whiter. But in representing the Agency of the railroads in handling express transportation, which is quite a factor in a way of revenue producers for the handling of express traffic over the various rail lines in passenger service. I find myself in about the same position as our friend who preceded me; it would not be becoming to comment on the service.

In respect to the hand to mouth practices so forcibly illustrated by Wr. Whiter I wish to enlarge on same from an ex-

press standpoint. We find out many of our country merchants do not carry the stock they formerly did sell from samples, going to the extent of securing deposit on their order before placing with manufacturers the quick service saving necessity of large capital investment. This practice applies largely with ladies to wear goods and that character of matter that comes out of New York, to a great extent, they have the goods sold before ordering. And that is one of the reasons why the express traffic has been able to keep up with the pre-war times. The competition of the railroads with their better freight service for L. C. L. to say nothing of the over the road trucks for short haul has been a large factor with the express. On the other hand much of the short haul is unprofitable. The over the road truck on the whole has cut into the earnings and is something that has to be reckoned with. I thank you.

PRESIDENT: I see Mr. Howard, Chief Engineer of the Union Switch and Signal Co., in the audience who is doing a great deal to get trains over the road with safety. May we hear from Mr. Howard?

MR. L. F. HOWARD: Mr. Whiter's reference to the million dollars a day taxation which the railroads pay has raised the following question in my mind:

If a railroad supply company is engaged in the design of devices to effect economies on the railroads, the designing engineers must have some idea of how much the device must earn for the railroad, in order to pay its own way, together with some profit.

It is easy enough for the designing engineer to estimate what the device must earn to pay for interest on the investment and for depreciation, but what estimating figure should the designing engineer allow to take account of the increase in taxes, provided the installation of a device involves addition to the capital account.

MR. WHITER: I can not answer that question because the question of local taxes is one that I have not figured on at all. Different states and municipalities boost the taxes on the least provocation. We have no way to figure what those increases may be. I think however the gentleman pretty nearly answered his own question, because the railroads are after improvements that will save them in operating costs all the time. In order to come to some determination as to whether or not they are justified in making the expenditure, they have got to know very closely what the saving will be. A saving of 5, 6 or

7 per cent would hardly justify the railroads in spending large sums of money. It has to be something greater than that to take care of these additional taxes that are always coming on us.

PRESIDENT: I think by this time you realize that Mr. Whiter is in position to answer almost any question you may want to ask him. I think we might resolve ourselves into an inquisition meeting.

MR. ANDERSON: I will follow that suggestion far enough to ask Mr. Whiter this question, since taxation has come up. The taxes are increasing every year. They will soon be $2,000,000 a day at the rate of increase mentioned by Mr. Whiter. There is an element of increase in the value of the property which affects this general valuation problem And in addition to the arbitrary increase in taxes which he mentions, the county and state taxing officials will boost the valuations, fairly or unfairly from the railroad's standpoint. Underneath all that is a general increase in the valuation of the community which is reflected in the valuation of the railroad property, and the fallacy of this whole valuation question as of several years ago is that the valuations in this country have gone higher in proportion to the wealth of the United States as estimated ten years ago. It was estimated ten years ago as $120,000,000,000. It was stated the other day that the wealth of the United States now is $375,000,000,000, so that there is a new increase which is supported by the general increase all over the country. I think Mr. Whiter can add a word from the inside viewpoint of the railroad on the valuation question as connected with the general increase in taxation.

MR. WHITER: As I remember the figures, since the LaFollette act, passed probably fifteen years ago, the government has spent about $15,000,000 and the railroads about $85,000,000 in working up these valuations of the various properties, and the work is not nearly completed and I do not know when it will be completed or whether it ever will be completed, but if it ever is completed the figures will be obsolete for the very reason Mr. Anderson has mentioned. Valuations are always increasing. If the Interstate Commerce Commission should finally decide that the valuations of the railroads as of 1913 are a certain amount, they will be absolutely obsolete and will not be a fair basis on which to name freight rates. So that as I see the thing it is just money and time wasted and thrown away. The railroads have very honestly tried to get at their costs as of that date, but they contend that is not a fair

basis on which to base the rates because today it would cost in many instances practically twice as much to duplicate their properties as the cost in the year 1913.

PRESIDENT: Has any one else any question to ask Mr. Whiter? Mr. Whiter, you have been more than generous in your treatment of the various questions that have been propounded and I wonder if you have any parting word by way of reply to anything that has been said, which you would like to give before closing the discussion?

MR. WHITER: I do not believe I have anything further to add.

COL. H. C. NUTT: I think Mr. Whiter has been so extremely generous in the information he has given us that it would be hardly a kindness to ask him to say anything more. I feel that I express the sentiment that rests in the back of the head of all of us when I say to Mr. Whiter that we appreciate more highly than I can express it, the privilege and the honor of having him come and present the information he has on the current railroad situation. And I wish to suggest to you, Mr. President, that we express our appreciation to Mr. Whiter by a rising vote of thanks.

The motion was duly seconded and prevailed by unanimous rising vote.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

FRANK I. ELLIS
Died January 16, 1927

J. V. STYERS
Died January 28, 1927

L. E. OSBORNE
Died January 30, 1927

WILLIAM S. GIBSON
Died February 2, 1927

WILLIAM F. RYAN
Died February 9, 1927

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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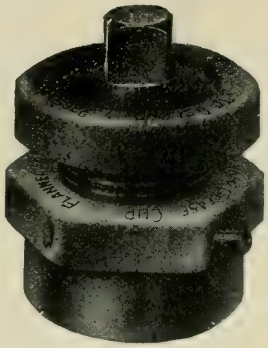
Vol. XXVI — MARCH 24, 1927 — No. 5

ALLOY STEELS IN THE RAILROADS

By F. J. GRIFFITHS, Chairman of the Board of Directors,
Central Alloy Steel Corporation, Massillon, Ohio.



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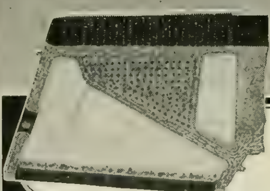

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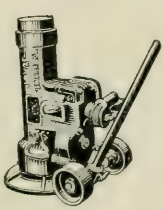

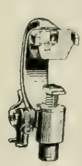

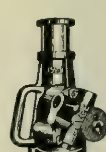

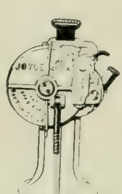

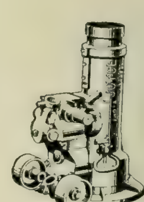

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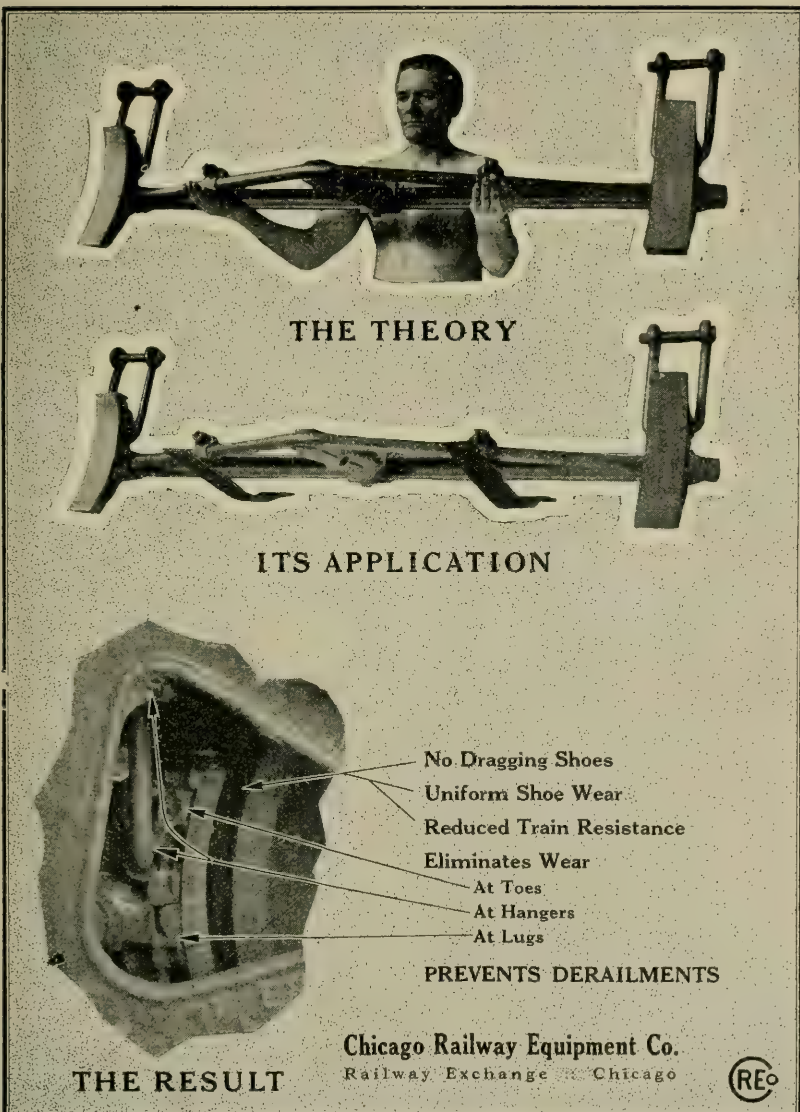
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OFFICIAL PROCEEDINGS
OF
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Organized October 18, 1901

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Vol. XXVI No. 5. **Pittsburgh, Pa., March 24, 1927** $1.00 Per Year 25c Per Copy

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

MARCH 24, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8:00 o'clock p. m., President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, L.
Adams, W. A.
Allen, E. J.
Allen, Harvey
Altsman, W. H.
Ambrose, W. F.
Anderson, A. E.
Baer, H. L.
Barrett, R. L.
Berg, Karl
Bonhoff, E. L.
Bradley, W. C.
Braun, L. H.
Brinkhoff, W. H.
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Cambell, J. E.
Cannon, T. E.
Chaffin, H. B.
Christy, F. X.
Conway, J. D.
Cotter, George L.
Coulter, A. F.
Cunningham, W. P.
Dalzell, W. E.
Dambach, C. O.
Davis, Charles S.
Dempsey, P. W.
Devans, E. J.
Doescher, Louis
Durkin, James E.
Earley, J. T.
En Dean, J. F.
Endsley, Louis E., Prof.
Faulkner, A. J.
Fenton, H. H.
Fisher, J. J.
Follett, W. F.
Frey, W. H.
Geddes, James R.
Geisler, Joseph J.
Glenn, J. H.
Hackett, C. M.
Gordon, George A.
Guignon, W. E.
Hale, Charles E.
Harter, Arnold
Haskell, B.
Hilstrom, A. V.
Hoffman, George P.
Hogg, Francis
Holleran, T. J.
Holmes, E. H.
Hood, D. G.
Householder, J. A.
Huber, H. G.
Hunter, Bernard E.
Hussong, Albert B., Jr.
Jordan, J. M.
Kelley, H. D.
Kelly, H. B.
Kelly, L. J.
Kirkpatrick, H. F.
Klassen, Fred G.
Knox, William J.
Kroske, J. F.
Kummer, Joseph H.
Landis, William C.
Lang, W. C.
Laurent, G. F.
Laurent, Joseph A.
Lawson, A. F.
Lehr, Harry W.
Lewis, Walter M.
Lobez, P. L.
Lohr, A. W.
Loughner, Geo. D.
Ludgate, B. A.
Lyman, L. S.
Maloney, J. J.
Miessner, V. H.
Mitchell, F. K.
Mogan, John M.

Morris, J. H.
Moyer, Oscar G. A.
Muir, R. Y.
McIntyre, R. C.
McLaughlin, H. B.
McNamee, W.
McVay, W. H.
Norris, J. L.
O'Connor, C. D.
Opperman, E. W.
Orchard, Charles
Painter, C. L.
Parke, F. H.
Patterson, J. E.
Peterson, E. J.
Peterson, William
Posteraro, S. F.
Rauschart, E. A.
Reckley, A. P.
Reddick, Warren E.
Redding, P. E.
Reese, O. P.
Reeve, George
Reifsnyder, J. W.
Reynolds, D. E.
Roberts, A. L.
Rowles, L. L.
Rushneck, G. L.
Rys, C. F. W.
Saltic, Thomas
Sayre, F. N.
Schrecengost, C. P.
Schultz, Charles H.
Seiss, W. C.
Severn, A. B.
Shannon, David E.
Shellenbarger, H. M.
Shelly, D. L.
Showalter, Joseph
Simon, Philip
Smith, J. L.
Smith, M. S.
Spielmann, J. A.
Spinning, C. F.
Sterling, C. C.
Stilwell, K. E.
Strachan, James M.
Strachan, M B.
Strohmer, J. L.
Sutherland, Lloyd
Taggart, Ross E.
Van Ryn, William
Van Wormer, G. M.
Warner, Russell H.
Warren, A. T.
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White, Robert H.
Wildin, G. W.
Williams, A. G.
Wirth, F. A.
Work, B. J.
Wynne, F. E.
Zeher, W. G.

VISITORS

Bourke, J. P.
Braun, Stewart R.
Carlson, Lawrence E.
Cooper, William M.
Croft, J. M.
Daerr, N. K.
Davis, William B.
Demmler, A. W.
Diven, J. B.
Dunn, H. E.
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George, Clyde A.
Glessner, G. P.
Grossman, M. A.
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Hastings, W. S.
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Milner, William M.
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Provost, William J.
Schultz, O. B.
Shafer, John S.
Sharp, H. W.

Small, G. C. | Taggart, J. G.
Smith, D. Ray | Tracy, T. W.
Smith, Sion B. | Uline, C. S.
Voight, Ben C.

The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Abair, L., Division Storekeeper, B. & O. R. R., 1531 Grandview Avenue, Pittsburgh, Pa. Recommended by H. S. Burkley.

Bourke, John P., Vice President, Ewald Iron Company, 501 Fifth Avenue, New York, N. Y. Recommended by George W. Wildin.

Bowler, R. W. E., Division Engineer, Pennsylvania R. R. System, 207 Pennsylvania Station, Pittsburgh, Pa. Recommended by H. G. Huber.

Carlson, Lawrence, Westinghouse Air Brake Company, 353 Marguerite Avenue, Wilmerding, Pa. Recommended by George L. Cotter.

Diven, J. B., Superintendent Motive Power, Pennsylvania R. R. System, 502 Pennsylvania Station, Pittsburgh, Pa. Recommended by H. G. Huber.

Earley, J. T., Ind. Sales Representative, O'Brien Varnish Company, Box 114, Saxonburg, Pa. Recommended by W. H. Altsman.

Eichorn, T. F., Asst. Superintendent of Production, Westinghouse Air Brake Company, 400 Caldwell Avenue, Wilmerding, Pa. Recommended by G. W. Wildin.

Gummere, W. R., Special Representative, Buckeye Portable Tool Company, Dayton, Ohio. Recommended by J. D. Conway.

Hoffman, George P., Sales Service Engineer, Grip Nut Company, 5917 S. Western Avenue, Chicago, Ill. Recommended by A. F. Coulter.

Horner, William, G. Y. M., Mon. Con. R. R. Co., 215 South Euclid Avenue, Pittsburgh, Pa. Recommended by M. B. Strachan.

Knapp, K. M., District Manager, Universal Steel Company,

Chamber of Commerce Building, Pittsburgh, Pa. Recommended by K. Berg.

McHugh, C. A., Asst. Train Master, P. & W. Va. Ry., 21 Cannon Street, Crafton, Pa. Recommended by R. L. Barrett.

McKenzie, Edward, G. Y. M., P. & W. Va. Ry., R. F. D. 8, Crafton P. O., Rook, Pa. Recommended by R. L. Barrett.

Schultz, O. B., Chemist & Engineer of Tests, Lima Locomotive Works, Lima, Ohio. Recommended by J. D. Conway.

Sharp, H. W., Mechanical Engineer, Verona Tool Works, 6619 Shetland Street, E. E., Pittsburgh, Pa. Recommended by Prof. Louis E. Endsley.

Shelly, DeWitt L., Westinghouse Air Brake Company, 353 Marguerite Avenue, Wilmerding, Pa. Recommended by George L. Cotter.

Stanyard, C. S., Ticket Agent, P. & L. E. R. R., McKeesport, Pa. Recommended by J. E. Hughes.

Tracy, T. W., R. H. Foreman, P. & W. Va. Ry., 183 Prospect Avenue, Ingram, Pa. Recommended by R. L. Barrett.

Trust, John F., Purchasing Department, P. & W. Va. Ry., 207 California Avenue, Avalon, Pa. Recommended by J. A. Hoover.

Voight, Ben C., Superintendent, Briggs & Turivas, 52 Bradford Avenue, Crafton, Pittsburgh, Pa. Recommended by E. A. Rauschart.

Wurts, T. C., Heavy Traction Section Head, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Recommended by A. P. Schrader.

PRESIDENT: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action than the payment of the current dues.

We are somewhat disappointed in not having with us the regular speaker of the evening. We have just received a telegram from Mr. Griffiths, Chairman of the Board of Directors of the Central Alloy Steel Corporation, that he will be unable to be with us on account of illness. But he has kindly designated his Chief Metallurgical Engineer to take his place, and who will read Mr. Griffith's paper, thus making it fortunate for us after all. I take pleasure in introducing to you Mr. M. A. Grossman, Chief Metallurgical Engineer, Central Alloy Steel

Corporation, who will present Mr. Griffith's paper, on the subject of Alloy Steel in Railway Use.

MR. M. A. GROSSMAN: Mr. President and Gentlemen: Mr. Griffith's wishes that I express to you his very earnest regret that he is unable to be here, for he would have enjoyed it very much. He is disappointed that it is necessary for him to designate a substitute. I can not do more than to read the paper which he has prepared. At its close, if there are any questions that I can answer I will be very glad to do so.

ALLOY STEELS IN THE RAILROADS

By F. J. GRIFFITHS, Chairman of the Board of Directors, Central Alloy Steel Corporation, Massillon, Ohio.

Alloy steels may be discussed today without offering any introductory remarks. It is almost trite to observe that they are in many cases replacing the old plain-carbon steels, and that this replacing process is going on because of the increased strength and resulting efficiency. What is sometimes overlooked, however,—and this point deserves emphasis,—is that alloy steels are being used most widely where the assembled machine is in motion. Again it is trite to refer to the automobile. But there are other important fields: the tractor, the huge oil-well drilling tools, the steel aeroplane,—all point the way to alloy steels where there is motion. Obviously, these users of alloy steels have come to use them not because they wished to pay more for their steels but because the slight increase in initial cost was far more than made up in decreased cost of operation. It has in every case been a matter of dollars and cents.

The term "alloy steels" connotes in the minds of most of us greater strength and rigidity, with increased mechanical endurance, for it is in this narrower and more restricted sense that the term is generally employed. But the phrase "alloy steels" should be extended to include all steels which owe unusual properties to the presence of alloys. Chief among such steels are the corrosion-resistant ones, both moderately resistant and highly resistant. Further, there are the steels having improved strength at somewhat elevated temperatures. These and certain other applications are everywhere extending the use of alloys to effect economies in operation.

The significance of this trend toward alloys has not been overlooked by the railroads. In spite of a conservatism which always characterizes large institutions, there is noticeable a

general trend in the railroad field today to adopt alloy steels in a wide range of applications. A list of such applications will be found to be already rather extensive. The account to be given here can therefore be restricted to proven materials. The instances cited will in all cases be based on tests of several years' duration, being thus of established merit and no longer in any sense experimental.

The railroads are using alloy steels today for improved mechanical properties, for increased resistance to rusting and corrosion, and for improved strength at slightly elevated temperatures.

The first application of alloys was probably the use of high manganese rails. The 12% manganese steel rails offer such extraordinary resistance to wear that their use became established very rapidly many years ago. They are also used today in all severe street-car subway service and in railroad crossings, switch points and regions where the wear would be excessive

The steel is used in the condition in which it is delivered from the rail mill and requires no further heat treatment.

The next application to become established was that of vanadium steel in locomotive frames, side arms, rods and pins. It was demonstrated that increased strength could be obtained without sacrifice of ductility, and this obviously made it possible to decrease the size of moving parts without loss of strength. After long experimental work in service, the use of carbon vanadium and chrome vanadium steels became quite widespread, and their use is now rather general. In this same field we also find experimentation for the use of other alloys, notably the nickel steels, the nickel molybdenum and the nickel manganese. All of these steels call for heat treatment, in order to develop the desirable properties in them, but the compositions have been arranged so that the heat treating is simple. The treatment consists merely in heating the forging to the desired temperature, and cooling it in air or in the furnace. Often a double treatment (two such treatments) is desirable, but the operations are still simple.

In addition to the above applications, where the steel is used either in the "natural" condition or after simple heatings and coolings, there are other cases where advantage is taken of the desirable properties of alloy steels obtained in more involved heat treatment. The best-known example is in springs. Leaf springs which were formerly made of carbon steel are now

made of silico-manganese or of chrome vanadium. These alloy steels are used because they give vastly increased life as compared with carbon steels. The fatigue failures of carbon steels are greatly reduced, the alloy steels lasting several times as long in service before failure occurs. These steels are used in the heat treated condition. The springs after forming are hardened by quenching, and are then tempered to give the proper resiliency. The service in coil springs has been less well understood than leaf springs, the result being that most railroad coil springs are still made of carbon steel. Recent tests with vanadium steels have however given encouraging results, and further tests are in progress with many different alloy combinations.

A more recent development, and one which has only lately emerged from the experimental stage and reached production, is the field of alloy steel bearings for railroad cars. The old bearing with its sliding friction is still in use everywhere, and suffers from the obvious disadvantage of waste of energy in motion, as well as the danger of hot-boxes. The new ball and roller bearings have such greatly reduced friction that their extra cost is far more than justified. This is well evidenced in the recent sudden increase in their use, and the prospects for wide adoption. Bearing steels are used in the heat treated condition, and indeed represent the science of heat treatmnt as brought to a high degree of perfection. Railroad bearings call for the finest and cleanest steel obtainable, and should be heat treated with the utmost care and precision to take advantage of all the hardness and toughness inherent in them.

In conjunction with the steel bearings, there is a tendency to use more care in the selection of axles. This becomes of special importance in connection with the steel bearings, because the latter in order to function properly should be kept in good alignment. Alloy steel axles with their greater strength are more capable of keeping the bearings strictly aligned, and it would seem that the use of ball and roller bearings may of necessity lead to the universal adoption of heat treated alloy steel axles.

A final application for heat treated alloy steels is found in staybolts and engine bolts. These materials call for a considerable amount of ductility and resistance to fatigue, as well as adequate strength at slightly elevated temperatures. The copper-bearing and nickel-bearing steels and irons have proven their worth in these applications and are receiving wider attention. In addition, a radical departure is found in the use of heat

treated chrome steel for staybolts. This interesting development is attracting considerable attention because of its novelty and apparent efficiency.

The steels listed thus far are the ones in which alloys are used to improve the mechanical properties. But there is a wide field, perhaps even equally great, where the alloys are used for the sake of resistance to corrosion. This is a separate field, and the problems encountered are quite different. In the former case, improvement in mechanical properties calls for heat treatment, and the alloys are therefore usually added to steels which are higher in carbon and are therefore susceptible of being heat-treated. In corrosion resistance, on the other hand, the mechanical properties have been of less importance, and the alloys need only be added to low-carbon steels or irons. These are used as prepared by the steel mill, and call for no subsequent treatment. These low carbon steels and irons receive additions of copper, or copper and molybdenum, or nickel, and their resistance to rusting and corrosion is thereby strikingly increased.

A field of prime importance is that of boiler tubes. Here resistance to corrosion is of importance because replacement costs are high and hazards great in the case of short life or defective tubes. These costs are being reduced by the use of alloy iron tubes. The alloy irons are obtained in the form of seamless tubes, which are worked and used in quite the same way as ordinary tubes.

Similar alloy irons are being used to good purpose as boiler plate and fire-box plate. Here too the desirable properties of the alloy irons soon pay for the slightly increased cost, and their adoption is becoming more widespread.

A further application is found in coal cars, where corrosion plays an important part. Not only the weathering, but also the water draining through the coal, causes increased corrosion which is minimized by the use of alloys.

In all applications then, where rusting and corrosion lead to deterioration, we find that early failure can be avoided by the introduction of alloys. It is interesting that in this case only a small amount of alloy is needed, which therefore does not raise the cost very greatly. The result is that a very surprisingly large saving is effected by using only slightly more expensive material.

Finally, mention should be made of a particularly corrosion-resistant material, having a high alloy content. The stainless irons are coming into wide use where high luster is required,

with permanent freedom from staining or rusting. These materials contain high percentages of chromium and sometimes other elements, and are necessarily more expensive than ordinary steels. But they are beginning to find very active applications in interiors where appearance is of importance, and it is for this reason that they have an obvious field in Pullman cars. We find this particularly in fittings in Pullman wash rooms, and to a certain extent in decorative hardware.

If we judge, then, by all of the above applications of alloy steels, we are led to but one conclusion. The application of alloy steels in the railroads, though already extensive, is just in its beginnings, and the possibilities are as varied and as extensive as the properties of the steels themselves.

MR. M. A. GROSSMAN: This is the end of the formal paper. If any questions are raised in your minds I will try my best to answer them.

PRESIDENT: We have found that this is a pretty broad subject. There is plenty of room for discussion if we get at it right. We have been fortunate in securing a few gentlemen to discuss this paper in a formal way. After we have heard from them we will turn the subject over to the meeting for general discussion.

I will first call upon Mr. C. F. W. Rys, Metallurgical Engineer, Carnegie Steel Company.

MR. C. F. W. RYS: Mr. Griffiths has in a very able and comprehensive manner given you a general outline of the development of special steels used in motive power equipment for transportation in every form.

The field is, as you know, an extremely large one and to discuss here today the many important phases of the manufacture and use of steels with higher mechanical properties is out of the question. Many of the commercially used and important applications have been given by the speaker and there is little to add in this respect. It might be of interest to mention also the following qualities of alloy steel which seem to give hope for rapid development and satisfactory results.

In rails a so-called Medium Manganese steel with about .50 to .65 carbon and 1.25 to 1.75 Manganese has been applied in quite considerable tonnage. This material is used as rolled, without even a simple treatment, which is rather exceptional for an alloy steel.

There is also a Molybdenum-Copper alloy rail steel under test just now, with the hope that better wearing properties may

be obtained. These alloy rails are also used as rolled without further treatment.

A similar exceptional case of an alloy steel untreated is developing in boiler steel for locomotives, by requiring an increase in physical properties of such material from 55/65,000 to 70/80,000 tensile strength. These physical characteristics are obtained by nickel or silicon as an alloy, the latter possessing the advantage of a more desirable surface finish, less fibrous structure, and last but not least, lower production cost. There are at the present time 40 locomotives under construction with this type of boiler shell steel.

Another simple alloy steel that promises to successfully take the place of the more complicated Nickel-Chrome, Chrome-Vanadium or Chrome-Molybdenum combinations is a forging steel in different carbon ranges with a 1.75 to 2.00% Manganese content. This type of course requires a full heat treatment.

Many more combinations will be worked out. The metallurgists of the steel industry will have plenty of work in store for them. There is Uranium, Zirconium, Iridium, and other elements which may through research and proper application impart still more desirable mechanical and physical properties to our "master metal" steel.

But while we are mentioning all these more or less rare elements as useful alloys, it would not be fair to overlook two which we meet in abundant quantities everywhere in nature. Both the steel manufacturer and the user often consider them arch enemies of quality, and qualified under certain circumstances quite correctly so. Great care is taken to keep them from entering into the process with the raw materials and the fuel; every precaution and metallurgical phenomenon are used to eliminate them during the process of making iron and steel And still under special quality requirements they must be recorded as alloys of considerable value. I am speaking of Phosphorus and Sulphur. Hundreds of thousands of tons of material are made where Phosphorus and Sulphur are added for a distinct quality purpose.

Now, generally speaking, and the exception proves the rule, alloy steels are mostly used in a heat treated condition. And speaking of heat treatment, it must be remembered that a simple alloy steel is also simpler of treatment. That means that the range of temperature is wider, there is less chance for error; and remember, erroneous treatment is worse than none at all. So where conditions permit, keep to the simple alloys such as

Carbon-Vanadium, Carbon-Chrome, Carbon-Molybdenum, Carbon-Manganese, Carbon-Nickel or Carbon-Silicon, as it will give you more safety in treatment.

When the physical and mechanical properties demanded are of the highest degree, requiring a steel containing more than one alloy, make sure that you have the proper equipment for treating, an operator who knows the proper critical points and who can control his operations in time and temperature with reliable instruments. If not, you may be sadly disappointed with results, and unfortunately for us as manufacturers, blame it unjustifiedly on a poor quality of steel.

Certainly nobody is more convinced than myself of the value of alloy steels and the undisputable necessity for their use and application. They will no doubt give the possibility for still greater development in motive power.

But correct heat treatment will impart wonderful properties; the simple alloy is safer in results as mentioned before. So, let us say a good word for the simplest steel properly heat treated, and that is the straight carbon steel. I know Mr. Griffiths will have no objection to that, because, although he is the Chief of an alloy corporation, he also manufactures high quality straight carbon steels.

So it will be of interest that right now there are being put into service full heat treated regular straight carbon 130 lb. rails of 45-foot lengths.

There have been in service with reamrkable results heat treated wrought steel wheels of regular carbon steel. You know that in our heavy traffic, trunk line rails are joined with heat treated high carbon splice bars with similar bolt material. High duty axles of fully treated carbon steel have successfully met the severe conditions of service. In many other applications the simple carbon steel properly treated has shown its usefulness.

But after all, whether plain carbon or alloy, the base principle on which rests the successful use of motive power equipment, lies in the proper use of the available raw materials for the manufacture of iron and steel, the proper process and metallurgical operation in the making, rolling, selecting, shaping and treating of the part which is to give safety and satisfaction in service. Every responsible manufacturer realizes this fact and that his business success is naught without it.

PRESIDENT: We will next hear from Mr. O. B. Schultz, Chemist and Engineer of Tests of the Lima Locomotive Works.

MR. O. B. SCHULTZ: During the reading of Mr. Griffith's paper the following remark was made: "Railroad bearings call for the finest and cleanest steel obtainable, and should be heat treated with the utmost care and precision to take advantage of all the hardness and toughness inherent in them."

This statement is applicable not only to bearings, but also to all of the important forgings on a locomotive, and since I am particularly familiar with locomotive forgings of carbon vanadium and chrome vanadium steels, I would like to call your attention to some of the phases of the manufacture and the subsequent forging and heat treating of these two alloy steels.

In an effort to increase their hauling capacities, steam locomotives have reached about the limit in weight on drivers for present track conditions. Therefore, it is necessary to make savings in weight wherever possible by the use of lighter sections of greater tensile strength. The alloy steels are ideal for this purpose, and as heat treating problems generally increase with the complexity of the alloy, the simpler alloy-steels are more adaptable to the facilities usually found in railroad shops.

Due to the wonderful results obtained by the use of these alloy steels, many railroads turned to their use without any consideration of the quality of the material, as long as they bore the names "Carbon-Vanadium" or "Chrome-Vanadium." Manufacturers who had no experience in making alloy steels rushed into their production with the inevitable result—some very bad steel was produced. Forging shops attempted to make locomotive parts with the same practice as had been used in the production of medium-carbon steel forgings.

The natural result of this mal-practice is, that with some of the railroad companies, alloy steels are not in good repute. Conditions, however, in these respects are continually improving, and today there are several manufacturers who are doing everything they can to make the best possible product. Forging methods are steadily being improved, and modern heat-treating furnaces are very capable of close control. All of these factors are absolutely essential to the production of sound forgings which will withstand the severe service demanded of them in railroad use. In the majority of cases, carbon-vanadium and chrome-vanadium steels are used in the normalized condition. Generally this process consists of heating the forgings in a suitable furnace well equipped with good thermocouples and recording pyrometers, to a temperature of 1550 to 1600° F. (845 to 870° C.), maintaining this temperature a sufficient length of

time to insure the entire forging having a uniform heat, and then removing the forgings from the furnace to cool in still air, protected from draughts and rain or snow. The forgings are sometimes used in this condition, by some fabricators, but they are generally too hard to machine well, so in most cases they are again returned to the furnace and "drawn back" at a temperature which will refine the grain and insure a tough, ductile forging. The temperature of the draw heat may be as low as 1100° F. (593° C), and as high as 1400° F. (760° C.) The forgings are sometimes cooled in the furnace, and sometimes in the outside air. One railroad company is just now using a high draw heat, and I have been informed that they have been obtaining some very good results in tensile properties from tests which they have made.

The usual specifications for alloy steel billets or blooms cover only the chemical requirements, with subsequent surface inspection to insure obtaining billets or blooms free from surface defects such as seams and slivers, or too deep chipping. The process by which the steel is to be made is sometimes stated, but the actual making of the steel is left to the discretion of the manufacturers, which is as it should be. But, take the case of the manufacturer who has been making carbon steels, and suddenly decides that he will make the alloys. He needs careful watching, because you cannot make good alloy-steel with ordinary carbon-steel practice. It is therefore essential that the purchaser familiarize himself with the steel he is attempting to use, in order to protect himself and his product. The usual inspection by the purchaser at the mill is entirely a waste of time and money, for almost all specifications for billets have a clause which provides that billets which show injurious defects while being finished by the purchaser will be rejected Since the manufacturer must stand the loss of the material and pay the shipping charges both ways, his mill inspection is usually more severe than that of the ordinary inspector. In other words—buy alloy steel only from reputable manufacturers, and don't hunt for bargains.

I am going to omit any discussion of the manufacturing process, and get to the forging of alloy steels in your shops. It is extremely important that the billets be carefully heated to the forging temperature. In the winter months the billets become very cold in shipping, and they should be placed inside the forge shop in a warm place for at least 24 hours before they are placed in the furnace. The best practice is to use a pre-

heating furnace into which the billets are charged at room temperature, and which is then slowly heated to not over 1000° F. (583° C.) at a rate of not over 150° F. (83° C.) per hour. This insures freedom from internal checks due to too rapid heating. The billets are then removed from the preheating furnace and placed in the forge furnace where they are raised to the forging temperature. The same precautions are necessary here as in preheating—do not heat too fast. The regulation of the fuel and air should be such as to obtain the least amount of deposit on the billets while heating, as this insures more efficiency from the heat of the furnace and lessens the chance of overheating. Billets should be soaked at the forging heat a sufficient length of time to insure complete penetration and absolute uniformity of temperature throughout. Sharp flames must not be allowed to come in contact with the billets or checks will be produced due to overheating, and there must be no local heating in the forge furnace. The temperature of the bloom or billet must not be greater than 2100° F. (1149° C.).

There are no standard rules for the working of the billet or bloom under the hammer, but a hammer of sufficient size to insure working to the center of the billet or bloom must be used. In working a large section, if the penetration is sufficient, the forging will have a tendency to bulge in the center and on the end. Too light a hammer results in very unsatisfactory physical results, and a test taken near the center of the forging will be not at all comparable with tests taken near the outside. A microscopic examination readily establishes this condition. If the temperature is too low for proper forging, there will be no penetration of sufficient depth, and the resulting forging will show evidences of cold work. Cold-worked forgings are in a strained condition which is not readily relieved in subsequent normal heat treatment. The following is the best rule that I know of for forging any kind of steel: "The working of the forging must stop when the steel ceases to work freely under the hammer."

It is very important to cool alloy steel forgings slowly after forging. A good method is to cover with ashes. This considerably lessens the likelihood of strains being set up or the formation of cooling cracks due to hammer strains.

Checks can be produced in the normalizing process by too rapid heating, for the forgings are usually cold when placed in the normalizing furnace, and too rapid heating may cause sufficient surface expansion to make the outside pull away from

the interior cold section. The rate of heat application should be maintained constant, and after the proper temperature has been reached, should be held for at least one hour per inch of diameter or thickness of the largest section of the forgings being treated.

In conclusion, it may be said that there are only two kinds of steel, "normal" and "abnormal" or good and poor. If a steel is normal, that is, if it has been properly made under right conditions and has been properly forged, the problem of normalizing to meet the usual specifications presents no difficulties whatever, and the forgings will withstand the severe service demanded of them in steam locomotive operation.

It has been a great privilege to have been asked to talk on this big subject of alloy-steels, and I hope that I may be excused for devoting my remarks to only two of them with which I am familiar.

PRESIDENT: Our next speaker will be Mr. J. W. Riefsnyder, Engineer of Tests, Pittsburgh Testing Laboratory.

MR. J. W. RIEFSNYDER: Mr. Rys's remarks concerning manganese rail steel and the analysis he has given differ quite materially from the manganese rail steel which was investigated when I was with the Pennsylvania Railroad some few years since. This investigation was brought about by reason of the fact that this road at that time was experiencing considerable trouble due to excessive head wear in rails on curves exceeding 4 degrees. All alloyed steel rails in use experimentally at that time were investigated, this investigation taking in practically all of the large railroads in this country as well as Canada. The manganese steel rails at that time showed a carbon content of approximately 1.25 with the manganese running around 11½ to 13 per cent. Among other alloyed rail steels we found chrome-nickel, Mayari (chrome-nickel) Titanium treated as well as high silicon rail known as the Sandberg rail, this latter rail having been used to some extent in Canada and in England.

As a result of that investigation it was recommended that the Pennsylvania Company give consideration to the purchase of rolled manganese rail on sharp curves but not in high speed track on account of the low elastic limit of the material which was found to be about 35 per cent of the ultimate. This rail receives no treatment except a water quench immediately after leaving the hot saws.

I do not know whether you gentlemen understand the re-

sistance this manganese steel offers to low temperatures. This was investigated during our trip and a very interesting series of comparative tests were made in liquid air, comparing the manganese steel with the ordinary Bessemer and Open Hearth rail material.

These tests consisted of placing short sections of each kind of steel in a tube which in turn was placed in a closed tank, liquid air vapor being circulated around the tube forcing the temperature of the bars by degrees down to the point where the steel became very brittle and broke. In these tests the Bessemer bars failed at 60 degrees below zero, the bars being withdrawn quickly from the tube and struck on the end. The Open-hearth steel bars failed when cooled to between 80 and 90 degrees below zero. Tests were carried on with the manganese steel bars down to about 240 degrees below zero, the specimen at this temperature not only failing to break but showing some ductility as was indicated by a slight bend at the center of the bar, thus showing the manganese steel bars to be much tougher at minus zero temperatures than the ordinary carbon steels. No investigation was made as to the effects of low temperatures on the other alloyed rail steels investigated.

It is a well-known fact that manganese steel of the foregoing composition is non-magnetic but however does not afford sufficient resistance to electrical currents to affect track signal circuits. There appeared to be quite a difference of opinion in regard to the latter point, but from a thorough investigation of this as well as information obtained from signal engineers, it was found that no serious trouble had arisen from the inability of manganese steel to conduct a sufficient amount of current for the proper operation of track signals.

MR. RYS: 11, 12 and 14% manganese rails with 1% carbon are still being made for special purposes. They are of course very good wear resisting rails, but on account of very high price they are only used on special work, such as the Horse Shoe Curve. The only trouble with them is that the rails batter at the end because the steel is ductile. What I mentioned in my discussion was the so-called Medium Manganese rail, of 1.25 to 1.75% manganese, which is used at the present time in thousands of tons in regular track work. For instance, the Delaware and Lackawanna have ordered all their rails of that composition this year. The Pennsylvania has put in quite a number of thousands of tons of this composition and

so has the New York Central. That is a rail for main track work, not for special purposes.

PRESIDENT: We have with us tonight a gentleman, connected with a corporation that makes that alloy metal with the unpronounceable name, Molybdenum, Mr. Eaton of the Molybdenum Corporation of America. We would like to hear from you.

MR. G. M. EATON: Mr. President and Gentlemen: This is an unexpected pleasure. I was very much interested in the discussion on the rail problem. We have been working for about seven years on the problem of a rail which would handle the wear difficulties and which offers some hope of combating the trouble which is so much dreaded by the railroads, viz. transverse fissure. I believe it is claimed Mr. Howard of the Interstate Commerce Commission has a collection of 90 theories as to the cause of internal fissures and he feels that there is not one of those theories that really meets the problem.

As we analyze the wear problem, resistance to wear is not a function solely of hardness. The best analogy I can give you is a grinding wheel. We know that a grinding wheel which has an extremely brittle bond simply evaporates under the service, and as a little elasticity is put into the bond, each little hard particle as it comes into service can yield just enough to get on without being loosened and knocked out. That is the picture I see when steel is asked to resist wear. With apologies to metallurgists, we will assume that each little grain is a particle that contributes hardness and the bonding of that grain gives it resilience and a little cushioning effect or fails to give it that effect. I will ask a little Christian charity in interpreting that analogy.

We have recently run into the case of two steels having very close to the same elastic limit and ultimate strength, but with a marked difference in Brinell hardness, the softer, but far more ductile steel outwearing the harder steel. Therefore, for wear resistance it seems utterly vital to go after ductility in steel with a high elastic limit, and get great elongation and great reduction in area. And that is the thought that was back of the molybdenum rail to which Mr. Rys referred and also back of another rail which has recently been rolled where the molybdenum in a very small percentage was put in to approximately the analysis of the medium manganese rail. Those rails have not been tested out as yet, but we are living in hope.

There are other sides to this problem of rail wear, and one

of them is that we are justified in assuming that when the rail wears the wheel wears, and there are developments under way connected with the use of alloy steel tires and alloy steel rolled wheels, and there is reason to hope that the railroads can be shown how to save money on the motive power and rolling stock as well as on the rail.

I would like to say a word as to the weight that one gives these experiments. Alloy steels have been shoved into big developments, head over heels, and have sometimes come a cropper. There are three main divisions to be considered in connection with the application of alloy steels to the railroads. First the steel mill practice; second the fabricating shop practice and the third the service conditions. The fact that an alloy steel has worked beautifully on another railroad as fabricated and used, does not prove that it will work as beautifully on your road as fabricated and used by you, and the only sane way is for each railroad to start with small trial installations, and after reasonable service tests and with fairly well determined results, decide whether or not to go into alloy steel on the basis of the dollar sign.

PRESIDENT: We have this evening a visitor on whom we would like to call because of his connection with an alloy corporation which has not been represented as yet, Mr. Demmler, metallurgist of the Vanadium Steel Corporation of America.

MR. A. W. DEMMLER: My information from the railroad angle is very much restricted. I was connected at one time with the Alloy Steel Corporation of Canton, now the Central Alloy Steel Corporation, and ran into a little locomotive and railroad work there, but primarily I am interested from the rolling mill end of the work rather than from the locomotive forging end, and anyone here that has had some railroad experience would probably be much better off without my attempting to elaborate on anything in the forging line. So it is probably better that I should leave it at that point. I thank you.

PRESIDENT: Mr. Bourke, vice president of the Ewald Iron Co., would you like to say a few words?

MR. J. P. BOURKE: No, I thank you.

PRESIDENT: The next gentleman to speak I will not introduce because he does not need it. I will ask Professor Endsley to speak to us.

PROF. LOUIS E. ENDSLEY: I am in deep water when you get to alloy steel. I know that alloy steels give about the same modulus of elasticity as ordinary carbon steel. Some of

you may not know what that means, but it simply means that the stress and strain relation of the two is about the same. It does seem to me that we ought to go into this alloy steel question a little carefully, as Mr. Eaton says. I was personally close to a railroad at one time that had some motion work on alloy steel that was wonderfully successful. An engine went into the ditch one day and it was necessary to replace it. So they replaced it with alloy steel material which they treated themselves and that engine did not go off the first division before they needed more motion work. So they condemned alloy steel, and they had a right to from their own experience. If good results are obtained with alloy steel care has to be exercised in its heat treatment. So I believe that railroads that go into the use of alloy steel on their roads should give it a great deal of thought and care as to the requirements in handling alloy steels in order to get the best out of them, and remember that in heat treatment of alloy steel, the furnace should be equipped with a pyrometer. I do believe that if we had given the carbon steels the extra attention which it really does demand and which we have given to alloy steels, we would have obtained better results with ordinary carbon steel.

PRESIDENT: That completes my private program of speakers. I am going to throw the subject open to general discussion. If you do not want to talk about it you can ask questions because a sufficient number have already spoken to show you that they know something about alloy steel and you can ask almost any kind of a question and some of them can give you an answer. I am waiting for volunteers.

MR. GROSSMAN: I might say a few words on some of the points that have been brought out. It was very gratifying and very interesting to hear Mr. Rys' discussion because we know he speaks from experience. One point he mentioned is worthy of emphasis, and that is that some of the materials that have been considered harmful, such as phosphorus and sulphur, have their place, but should be approached with caution. Another interesting case is copper. Some years back it was a general saying that copper must be kept out of steel because it made the steel brittle, but we know now that it imparts useful properties sometimes. I think that is worthy of a great deal of emphasis, and I am very glad he brought it out.

MR. A. L. ROBERTS: We have heard a lot about alloy steels. It occurred to me that perhaps there are some here who do not know exactly what an alloy steel is. I think it might be

well if Mr. Grossman or some one else would explain just what are considered alloy steels.

MR. GROSSMAN: That is not as simple a question and does not get as simple an answer as you might thing. Our conception of an alloy steel, metallurgically, is a steel to which enough of an element other than carbon has been added to change any property significantly and favorably. If elements are added which affect the properties and affect them adversely, they are impurities; if elements are added which affect the properties favorably, they can properly be termed alloys. And I think that applies to any element other than carbon. For instance a dispute might come up over manganese and silicon because we know manganese and silicon are present in all plain carbon steel of the killed type. Yet when these are present beyond the ordinary amounts, this 11¼% manganese steel for instance, the properties of the steel are affected favorably and significantly. And the same applies to molybdenum and phosphorus and silicon and titanium and zirconium and so on.

PRESIDENT: Are there any other questions? If some of you do not open up I am going to call on Mr. Anderson. He will always talk when requested and that is why I like to ask him.

MR A. E. ANDERSON: Well, I did prepare some data on the historical feature, but this is such a technical discussion that I do not know whether it is proper or not.

PRESIDENT: We have got to fill up the time. Go ahead and read it.

MR. A. E. ANDERSON: We have had discussions at several meetings upon the question of education and for years I have argued that every man that had some information that other men did not possess coming out of his own experience, he should put that information in the form of some record that would be useful to his associates and neighbors and particularly those who come after him who had no opportunity to acquire that knowledge. Just the same as I advocated to Robert Pitcairn years ago that as one of the pioneers in the development of the railroads in the Pittsburgh district he ought to dictate to his stenographer his experience as he had opportunity. He said he would do it, but as far as I know he never did. So an immense mass of data as to the historical perspective that would be very valuable now has gone to waste in that manner. Therefore, in my reading and to conform theory with practice, and remembering that when you

have progressed, no matter how far, like an engineer when he starts out on a survey and has proceeded a certain distance, he takes a back sight to the last point of survey so that he knows he is correct. In some reading during the last month I saw the opportunity to collect some data which I thought would be of value to this record, first to show the progress we have made, and secondly to prove what I have said here a number of times that any one now with our libraries in the position where they are, can acquire an education regardless of what advantages or disadvantages he may have had in his youth; and thirdly I wanted to bring out the relation to the iron and steel industry in Pittsburgh of at least three of our greatest characters we have had in history.

Iron has been used from time immemorial as wrought iron, but in cast form as cast iron, or pig iron as furnace iron is called, its use began about 1350. Progress was slow as smelting could only be done with charcoal made from wood by long process and dependent upon forest supply near the forge or furnace.

William Penn was interested in forge and furnace work at Hawkshurst in England, so that when he was granted Pennsylvania, March 4, 1681, by charter from Charles II, and at the present 1927 session of the Legislature, made a Pennsylvania holiday, so that every four years Presidential inauguration day and William Penn charter day will be the same, he caused search to be made for ores and urged settlers to make iron. In 1716-7 Thomas Rutter built the first forge for manufacture of iron in Pennsylvania, Pool Forge, on the Manatawney Creek, three miles above Pottstown, Montgomery county, and ore is still being mined from the same beds. In 1720, Thomas Rutter and Thomas Potts built Colebrookkdale Furnace, the first blast furnace in Pennsylvania, named for same name in Shropshire, England, located on Iron Stone creek, first to cast pots, kettles and such articles. By 1724, produced 48 tons of pig iron a year, 5 pounds or $25 per ton, Berks county.

Mordecai Lincoln, great-great-grandfather of Abraham Lincoln, lived in Exeter township, Berks county, owned 1,000 acres of land, had interests in iron furnaces, built a small house in 1733, which now forms one end of present building, which remained in the Lincoln descendants to 1912. Lincoln men in Berks county were all men of note; one Abraham Lincoln, married Anna Boone, sister of Daniel Boone, also born 1735, in Exeter township. Abraham died in 1806. Three years before the war

Abraham was born. The Lincolns were of Quaker stock, which showed in the war President's attitude towards denominationalism of his day, and which explains his mysticism which flowered in the Gettysburg address with its eternal value.

Coventry Forge in Chester county was built in 1717, second in Pennsylvania. Mordecai Lincoln worked here and was part owner in 1725. Warwick Furnace, Rutter and Potts, built in 1737, first Franklin stove cast here. In Bucks county, Durham Furnace built in 1725, by 1758 became best furnace in country, and run to 1794 when blown out. Other forges and furnaces were built surrounding Pottstown founded by John Potts, perhaps son of Thomas Potts.

The Principo Company of Virginia and Maryland (Guide Book of Pennsylvania, 1926, Carnegie Library 917.48A66 British and Virginia capitalists,) began the manufacture of pig iron in Maryland in 1717, and the following year shipped 3½ tons to England, the first exported from America. Augustine Washington had the contract for getting out the ore, hauling it two miles to the furnace, and then hauled the pig iron six miles to Potomac Landing. He bought up iron ore lands in King George County, Va. between Bridges Creek and Fredericksburg, which he sold in 1725 to the Principo Company, and devoted the balance of his short life to this iron industry, living on the Ferry farm, near Fredericksburg. He died April 1, 1743. George Washington was born at Wakefield in 1732, was 11 years old when his father died, Mother, Mary Ball, second wife, and George her first child. George had older half brothers, Lawrence and Augustine, the former getting Mt. Vernon, named after Admiral Vernon, and the latter Wakefield. Lawrence left Mt. Vernon to George subject to dower of widow, made 15,000 pounds of tobacco, paid to 1751 when she died. Lawrence died in 1752 at the age of 34, born in 1818, same year as first pig iron was shipped to England. In 1748, Lawrence and Augustine Washington with other Virginia, Maryland and British capitalists, formed the Ohio Company and obtained from the King 500,000 acres of land on the Ohio, and Lawrence as American manager, built a fort near Pittsburgh, which may have been within such tract, and this work led to the French and Indian war, 1754, and the Revolution, 1776, and independence. In 1751, the Prnicipo Company controlled the foreign iron market, exporting 3,000 tons, as compared with 200 tons from Pennsylvania and 60 tons from remainder of the country. At this time total production in England was less than 17,000 tons.

Augustine Washington had one-twelfth interest in this company in addition to his above contract. The Virginia ore gave out in 1752-3, while Lawrence Washington was resident officer, succeeding to his father's interest. In 1780, Maryland confiscated this property, which was sold for 90,000 pounds. George Washington ,as successor to Lawrence, his half-brother, received 7,500 pounds for his one-twelfth share, $37,500 more or less as value of pound may have then been fixed. Thus we see that William Penn was an iron master and George Washington also in his own right and as descendant of iron masters, and Abraham Lincoln, war President, was also descendant of iron masters, facts of intense interest to us in Pittsburgh as the center of the iron and steel industry.

(Family Life of Washington, Charles Moore, with introduction by Mrs. Theodore Roosevelt, 1926, Carnegie Library,92w272mo.)

In all England in 1737, there were 59 furnaces, which produced 17,350 tons of pig iron, about one ton per day per furnace, or 59 tons per day for all furnaces, requiring import of 20,000 tons of Swedish iron. Lack of charcoal with forests being reduced forced experiments with coal, leading to discovery of method of making coke, and invention of better blast furnace, with use of Watt's steam engine instead of tread horse mill or water power, used also to pump water out of mines and raise coal, allowing deep shafts to be dug in addition to drift mines. In 1854, pig iron tonnage in England reached 3,100,000 tons with greater growth since in England and United States.

(Elementary Economic, by Fairchild, et al, three professors of Economics in Yale College, 1926, Carnegie Library, 330F157.)

From three somewhat unlikely sources, properly found in Carnegie Steel libraries, the above iron data has been gathered, proving my contention that all needful knowledge can be gained by college or non-college men from new books on all subjects coming from the press in a flood, which leads to the story that Mordecai Lincoln of the second generation of the Lincolns in America at New Hingham, Mass., about 1640, became the original and pioneer slack water dam man of America, for he built three mills and three dams in succession for storage of same water, so that in dry seasons, with but two days' supply, he operated for two days his saw mill, then for two days his iron mill, and then for two days his grist mill, week by week with conservation to the third degree in intensity for flood prevention. There is no

excuse for book ignorance except long-time employment or other unavoidable reason.

To the railroad men in daily contact with the immense tonnage of coal, coke, iron and steel and products therefrom or aided thereby, the above small beginnings of an average of one ton a day per furnace compared with tonnage, 1,500 and over of the modern blast furnace bring a realization of the progress made, and this is emphasized by the fact that iron making in Pennsylvania and Virginia and Maryland in 1717 was 110 years before the granting of the charter of the Baltimore and Ohio Railroad Company in 1827, first century of iron making followed by the second century of iron and steel making reaching 50,000,000 tons annually by almost automatic machinery compared with laborious handwork of charcoal furnace and forge. The deepest appreciation of those early pioneers in modern civilization based upon iron and steel should be had by us all, coupled with just pride in the opportunity to carry forward the heritage thus descending to present generations of railroad men.

I think that makes a good comparison with the intensely technical discussion of this evening, to show what progress was made, and when we look at the accomplishment of only one hundred years it is difficult to predict what can be done in the future. But when you consider that those old ironmasters with all their imperfect methods and materials, yet had the basis for all the advance we have now, it seems worth while to put this on the record to give us a sort of bird's eye view of iron from the dawn of history to the present time.

I have read also two books on metallurgy that I got out of the library, in which emphasis was laid on the fact that within ten years the processes of metallurgy have been entirely changed and overhauled and improved so that the practice ten years ago is thoroughly out of date with the practice now. So that I think I have proved my contention that nobody needs to be without information of all sorts that they can get out of the library from books that are coming out on all subjects in 1925 and 1926 and very recently an issue of 1927 on the application of scientific principles to advertising.

Now, Mr. Chairman, I would like to ask a question in line with the subject of the paper, now that I have filled up enough time to warrant it. It refers to the question of expansion and contraction in close quarters. Speakers have mentioned the fact that rails are now being rolled 45 feet long, that the length has

been extended from 33 to 45, and I would like to know what effect that has, if any, on the extent of expansion and contraction, as affected by the addition of alloys to the steel. I was also interested in the speaker's definition that where it is good it is alloy and where it is bad it is impurity. That would have helped Professor Endsley out and would have avoided the damnation that was passed on alloy steel.

On the question of expansion and contraction, I would like to know the effect of the alloy on that.

MR. GROSSMAN: Unfortunately, as far as I know of the alloys used at the present time, they have no effect on expansion and contraction. I think that is approximately true.

MR. ANDERSON: I would like to ask another question, as to whether the use of alloys is going to result in the reduction of tonnage of steel rails or driving wheels on locomotives or wherever it would be used in the building of steel structures, will the alloys increase the strength to the extent that the tonnage can be reduced to any appreciable amount?

MR. GROSSMAN: That has to be answered decidedly yes in some cases, and undoubtedly no in other cases. You refer to the use of less weight per structure. The outstanding case of that is the automobile today as compared with the automobile of a few years ago. Certainly where the fuel consumption is a factor, on railroads as well as automobiles, that must be a part of the story. The popularity of the light automobile today is certainly due to its economy of operation, and that is due to the fact that stronger structures can be built with alloy steel.

Reference was made by Professor Endsley to the modulous of elasticity, and unfortunately that is one of the factors in steel that has changed almost not at all by the use of alloys. A few months ago I asked the director of research of the General Motors Corporation what outstanding improvement was needed most in automobile steel, and he said: "Devise a steel with three times the modulus of elasticity." I think I am correct in saying that today we have only caused an improvement of about 10%, which is almost nothing. If we have anything better I have not seen it.

PROFESSOR ENDSLEY: You mean there is no change in the modulus.

MR. GROSSMAN: There is no change with the exception of the tungsten steel, which is out of the question for automobiles at present.

PROFESSOR ENDSLEY: I would like to discover a steel that has three times the modulus. It would be a nice thing if we could make a steel that would only stretch one-third as much as the present steel under the same stress. You would have some nice new problems. But we do not have any alloy that changes the modulous to any extent.

Answering Mr. Anderson, we do have an alloy steel, known as Invar steel, that contains about 36.2% nickel that has only about one-tenth the expansion per degree of temperature rise. This steel is used for scientific instruments, and clock pendulums.

PRESIDENT: I would like to ask a question myself. I would like to know if any of the gentlemen who have discussed this paper can tell me of an alloy steel within reasonable limits in price that is non-corrosive when applied to air reservoirs on locomotives? We have been unable to find it and if there is such an alloy I would like to know what the name of it is.

MR. GROSSMAN: Unfortunately that points out the incomplete state of metallurgy that we are in today, due to the fact that there isn't any answer to that. Those that are non-corrosive are expensive and those that are within reasonable limits of price are not sufficiently non-corrosive for that particular application.

PRESIDENT. What would a non-corrosive steel for that purpose cost per pound, approximately?

MR. GROSSMAN: Between 15c and 30c per pound.

PRESIDENT: Are there any further questions? If not, I will ask Mr. Grossman if he desires to add anything further in closing the discussion.

MR. GROSSMAN: There is one aspect of this that is of particular interest to us, that has been brought out and emphasized a number of times this evening, and that is the matter of quality in steel. We are discussing primarily the effect of alloys on the mechanical properties. Involved in that is also the matter of what we call purity, which is the absence of impurities or conditions which harm the steel. It was pointed out several times that in order to take advantage properly of the alloys in any steel, the steel must be made with proper care and proper selection of raw materials and with constant care in the course of maufacture. That was emphasized by Mr. Rys, who has had a great deal of experience (he would probably tell you it was too much experience) with the difficulties that are encountered all the time. That aspect must be kept in mind at all times

when you consider alloy steel, not only the function of the alloy but the proper manufacture and treatment of the steel.

PROFESSOR ENDSLEY: Before we adjourn, I would move that a vote of thanks from this Club be extended to Mr. Griffiths for preparing this paper and to Mr. Crossman for coming here and reading it and also giving us the discussion of the paper which he has, because I feel that it has been very enlightening to us and has given us all something to think about.

The motion was duly seconded and prevailed by unanimous rising vote.

PRESIDENT: I wish to extend on behalf of the Club an expression of our appreciation to the gentlemen who have come here from a distance to discuss this paper, and to all those who have taken part in the discussion.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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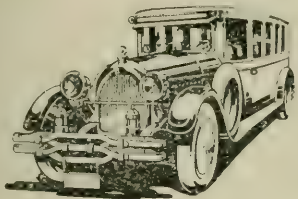
Corrosion and Pitting in Locomotive Boilers

By MR. C. A. SELEY, Consulting Engineer, Locomotive Firebox Company, Chicago, Ill.

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A. G. MITCHELL	November, 1912, to October, 1914
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J. G. CODE	November, 1916, to October, 1917
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A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

APRIL 28, 1927

The Meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 7:00 o'clock p. m. (Eastern Standard Time), President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
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Cunningham, R. I.
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Doescher, Louis
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En Dean, J. T.
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Freshwater, F. H.
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Geddis, James R.
Glenn, J. H.
Goda, P. H.
Godfrey, C. H.
Gordon, George A.
Gummere, W. R.
Hackett, C. M.
Hale, Charles A.
Hale, O. R.
Hamilton, William
Harger, M. L.
Harter, Arnold
Hilstrom, A. V.
Holleran, T. J.
Holmes, E. H.
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Johnson, Nelson E.
Kelly, H. B.
Kempton, J. W.
Klassen, Fred G.
Kroske, J. F.
Kummer, Joseph H.
Lawson, A. F.
Lewis, Herbert
Lewis, Walter M.
Lobez, P. L.
Lohr, A. W.
Lowry, William F., Jr.
Lynn, Samuel
Maloney, J. J.
Mitchell, W. S.
Milliken, Col. Jas.
Moir, W. B.
Moses, G. L.
Moyer, Oscar G. A.
Muir, R. Y.
Myers, W. H.
McGrann, E. R.
McHugh, C. A.
McKedy, H. V.
McQuillen, J. J.

McVay, W. H.
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O'Sullivan, J. J.
Overstake, Roy
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Peterson, William
Prince, Albert
Provost, S. W.
Ralston, J. A.
Rauschart, E. A.
Reddick, Warren E.
Redding, P. E.
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Rogers, Robert
Saltic, Thomas
Seiss, W. C.
Seley, C. A.
Severn, A. B.
Sharp, H. W.
Sharp, James
Shellenbarger, H. M.
Sheridan, T. F.
Simons, Philip
Spinning, Charles F.
Stebler, W. J.
Stoller, Karl M.
Sutherland, Lloyd
Tracy, T. W.
Trowbridge, F. A.
Van Vranken, S. E.
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Smith, Sion B.
Snyder, J. A.
Taylor, Harris L., Jr.
Timko, Michael
Williamson, J. A.
Winwood, H.

PRESIDENT: The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Abraham, Walter S., Inspector, Westinghouse Air Brake Company, P. O. Box 666, Wilmerding, Pa. Recommended by G. W. Wildin.

Bickelhaupt, Ivan A., Manager Railroad Department, Pittsburgh-Des Moines Company, Professional Building, Pittsburgh, Pa. Recommended by Samuel Lynn.

Bigleman, E. P., Yard Master, P. & W. Va. Ry., Gormley Avenue, Carnegie, Pa. Recommended by R. L. Barrett.

Bruce, S. S., Traffic Manager, The Koppers Company, Union Trust Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Carey, Charles D., Manager, American Steel Foundries, Verona, Pa. Recommended by Samuel Lynn.

Craig, W. J., District Boiler Inspector, B. & O. R. R., 206 Trenton Street, Hazelwood, Pittsburgh, Pa. Recommended by H. J. Burkley.

Glosser, W. W., General Sales Manager, Verona Tool Works, First National Bank Building, Pittsburgh, Pa. Recommended by Louis E. Ensley.

Hart, W. F., President Verona Tool Works, First National Bank Building, Pittsburgh, Pa. Recommended by Prof. Louis E. Endsley.

Jones, Louis E., Department Manager, American Steel Foundries, North Wrigley Building, Chicago, Ill. Recommended by Samuel Lynn.

Justice, R. W., Distributor, E. F. Houghton & Company, 610 Washington Road, South Hills Branch, Pittsburgh, Pa. Recommended by J. J. Hatcher.

Kane, J. P., Master Blacksmith, B. & O. R. R. Co., 21 Mansion Street, Pittsburgh, Pa. Recommended by H. J. Burkley.

Leisenring, W. J., Salesman, American Locomotive Company, Farmers Bank Building, Pittsburgh, Pa. Recommended by S. W. Provost.

Loudenbeck, H. C., Chief Chemist, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

McBride, W. H., Vice-President, Patterson-Sargent Company, 1261 Manor Park, Lakewood, Ohio. Recommended by G. W. Wildin.

O'Reilly, James A., Federal Inspector, United States Government, 704 Peoples Bank Building, Pittsburgh, Pa. Recommended by H. J. Burkley.

Reed, Hon. James H., President, B. & L. E. R. R. Co., Union Trust Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Richardson, F. E., President, Pittsburgh Forge & Iron Company, Chamber of Commerce Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Snyder, J. A., Chief Inspector, Hartford Steam Boiler Inspection & Insurance Company, Arrott Building, Pittsburgh, Pa. Recommended by Samuel Lynn.

Thornton, Sir Henry W., President, Canadian National Railways, Montreal, Quebec, Canada. Recommended by J. D. Conway.

PRESIDENT: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action.

The Secretary announced the death of the following members of the Club: C. M. Hawkins, H. B. Thurston, C. L. Welty.

PRESIDENT: Appropriate memorial will appear in the Official Proceedings of the Club.

I believe this disposes of our routine business. If there is nothing further, we will proceed to the paper of the evening, which is on the subject, "Corrosion and Pitting in Locomotive Boilers." We have with us as the principal speaker of the evening a gentleman who needs no introduction to men who have been in the railroad game, and probably will need introduction to but few of the men who have not had railroad experience. He is one of the foremost mechanical engineers in the United States. His experience has extended over seven or eight different railroads, all of them of the very first class. What he will have to say this evening is gathered from his long experience in Railroad Work and his accurate knowledge of the subject of which he is going to speak. I take pleasure in introducing to you Mr. C. A. Seley, Consulting Engineer, Locomotive Firebox Company, Chicago.

CORROSION AND PITTING IN LOCOMOTIVE BOILERS

By MR. C. A. SELEY, Consulting Engineer, Locomotive Firebox Company, Chicago, Ill.

The Railway Review, in December, 1925, inaugurated a prize contest, to be covered by papers on the above subject. The judging committee members selected by three Railroad prsidents were Messrs. Bentley, Hickox and Segwick, respectively a General Superintendent Motive Power; a Hydraulic Engineer and an Engineer of Tests. The award went to Dr. W. M. Barr, consulting Chemist of the Union Pacific Railroad and his paper was published in the Railway Review, issue of June 5th, 1926.

Three others of the papers submitted have been published by the Railway Review under following dates: August 21, 1926, by W. A. Pownall, Mechanical Engineer of the Wabash Railroad; on September 4th, 1926, by L. O. Gunderson, Chemical Engineer, Chicago & Alton Railroad and on September 11th, 1926, by F. N. Speller, Metallurgical Engineer of the National Tube Company.

Thus are included the views of Railroad Chemists, a Mechanical Engineer and the tube manufacturer's Engineer, on the question under discussion.

These authorities are agreed that corrosion and pitting are caused by electro-chemical action, set up by gases carried by, or constituents of, the boiler water; the results also being varied by qualities of the boiler material, temperature, stresses, etc., all more or less fully anaylzed.

The prize paper concludes with six recommendations and it is now proposed to review these in turn, with brief resume of the reasons therefor and views of the other writers.

1. "Select boiler materials with care, securing material of uniform and constant composition." It appears that various metals have differing electric potentials, and when combined in a structure and the boiler water acting as an electrolyte, electric circuits are set up, and the results are what is known by the more familiar term of electrolysis, well known as to results if not as to cause.

As an example, Dr. Barr refers to the enormous strain and modification of the crystalline structure incident to the manufacture of cold drawn steel tubing; which, unless perfectly annealed is susceptible to corrosion and states that hot rolled

tubes, which are not so stressed in manufacture, and with possibly greater uniformity of structure, are worthy of consideration.

Copper bearing steel is slightly electro negative to non-copper bearing and two of the writers cite this as useful in certain cases, to control relative potential of parts of the boiler. All this may be somewhat deep for the average Railroad officer, but there is no doubt of the desirability of consideration.

2. "In working the metals of boiler cosntruction, see that no part is left under strain in the crystalline structure."

This has more particular reference to flanging and assembly practice, calling for annealing and correct alignment and support of connected parts. Much so-called annealing is worse than useless and should be omitted unless properly done. In annealing, unless the temperature is evenly brought up to and a little beyond the degree of recalescence of the steel, the crystalline structure which may have been over-stressed or coarsened by over-heating is unchanged and the process is ineffective.

There is a question as to whether cold bending, as in rolling or some flanging will deteriorate steel, if done in moderation, with curvature of considerable radius. Hot working of large parts is more liable to leave internal disturbance and stress, due to necessarily uneven temperatures in various parts of the sheets that have to be worked.

No one will deny the advantage of absence of any initial internal and unequal stresses in the members of a structure that is to be subsequently loaded closely to the factor of safety for which it is designed. Is it not equally important, in all the phases of operation of the structure; which in the case of a locomotive boiler, would mean the firing up; operation, whether running or standing, and the later housing and cooling down, should be performed with a minimum of stresses, over, above or outside these incident to the pressure loading, which latter is adequately cared for in proper design.

Some of the writers have referred to this feature, which will be treated later on.

3. "In handling water treatment, remove incrusting matter, and carry an excess of caustic soda as far as operating conditions will permit, up to five or six grains per gallon if possible.

The above is a large subject, practically agreed to by the writers quoted, who also admit that the character of boiler waters and the service varies so much on the railroads, that the extent of water treatment must be measured by local con-

ditions and no fixed general rule will apply. In other words, the service of a water engineer is essential for proper handling; not only to designate the means and extent of the treatment, as insuring delivery to the locomotive tender, of water freed from all reasonably removable incrusting matter, but also, to designate and arrange for any subsequent treatment in the tender or boiler that will obviate foaming or relieve undue concentration.

The comparatively new feature of so-called embrittlement by over treatment is referred to, and there is now much of authoritative data on this subject, however, the conditions of operation of locomotive boilers do not, as a rule, permit such treatment as would be serious in this respect.

4. "Maintain low concentration of dissolved salts in the boiler water by systematic use of the blow-off and frequent washing or changing of the water, using hot water washout plants."

No doubt the above is very good advice for a majority of railroads, as those blessed with good and very good boiler water are relatively few. Here again local conditions and intelligent supervision are needful, in the matter of blowing off, as each blow-off is a loss of heat and energy, otherwise available in service, and figuring in fuel accounts and coal per 1000 G.T.M.

On the other hand, if systematic blowing off will promote the serviceability, which means less time in shops and round house, and more on the road; the perhaps trifling, loss of heat thereby may be fully justified.

There can be no doubt of the advantage of "real" hot water washing and filling plants which will be referred to later.

5. "Remove oxygen and other dissolved gases from the water as far as possible. The open feed water heater, while thus far inadequate, is the best means at hand, and improvement will doubtless be made in this class of equipment."

The quoted writers are agreed upon the electro-chemical theory, and in analysis state that hydrogen ions dissociated through the salts or water is the corrosive agent, but the presence of oxygen in the water adds the fuel, so to speak, in the formation of iron oxide or rust, the visible corrosion evidence.

This seems to be the gist of many paragraphs of the detail of the process of corrosion. It is evident therefore that oxygen, so useful in the fibrebox is very detrimental in the water, hence the recommendation to remove it.

De-aerators are used to some extent in stationary boiler

practice but not specifically on locomotives. Assuming the truth of the electro-chemical theory of corrosion, one contributing feature to oxygen saturation of boiler water is the very general use of under-water introduction of feed water by check valves located below the water line, thus not permitting the escape of gasses into the steam but immediately amalgamating the feed and thus re-enforcing the oxygen content of the boiler water.

If the feed water is introduced into the steam space and by spraying or by subdivision and trickling over considerable open surface in the steam, before mingling with the boiler water, it would enable the escape of these gases into the steam, which is rapidly used and carried out of the boiler in service.

Locomotive design abroad employs some such means, and it is stated to be with gratifying results in boiler maintenance.

6. "Last and most important of all, provide for competent supervision of water treatment and the use of water in locotives by having a thoroughly trained and responsible officer in charge of this work, with an adequate staff to handle all phases of the problem. Such an officer must have the fullest co-operation of the mechanical and operating department of the Railroad."

This is a necessary corrollary or amplification of discussion already given under Recommendations, Nos. 3 and 4.

The steam boiler, as found in power houses and general stationary practice, runs days and sometimes weeks without inspection or repairs of any kind, while the locomotive boiler is the most inspected and repaired type of steam boiler in existence.

The reason for all this inspection and repairs must be due to the structure receiving undue stresses and strains evidenced by cracks, leaks and rapid aging, to which the average stationary boiler is fairly exempt. True, the latter is housed and not exposed to the elements but it is a fact that tests show a higher efficiency of the locomotive boiler when in service than of the best type of power house boilers.

Locomotive boilers tested at the St. Louis exposition gave efficiencies over 75% and several over 78%, while the average of 30 tests on a well-known high grade stationary boiler as shown in their literature was 72.6% efficiency of boiler and grate.

In addition to the housing these stationary boilers are designed and built on a theory of circulation, both of water and

gases. The velocity of the water travel through the inclined bank of tubes in the water tube type of boiler is from 16 to 20 lineal feet per second. This moves all the boiler water so constantly and vigorously that the structure of the boiler has but a slight range of temperature to set up stresses over or beyond those accounted by direct pressure.

The gases developed by combustion over the grate are led by suitable baffles over and around the tubes, so as to effect heat transfer and be discharged to the stack and promote natural draft in most cases.

The locomotive boiler has to be designed to fit in with a wheel arrangement; with a firebox at the back end and stack at the other end, the gases being passed through tubes and flues to the front end. Thus there is really a firebox section and a flue section, and while the water and steam are common to both; yet due to the fact that the boiler is horizontal and natural circulation of water when heated is upward, there is no decided tendency of the water in the flue section, to move to the firebox section, except to replace the water evaporated into steam at the firebox end, unless there are special circulation means provided.

Thus, as has been observed, there may be a difference of 40 to 50 degrees between the temperature of the steam at the top of the boiler and that of the water at the bottom, particularly at the front end when in service. These water and steam temperatures are of course communicated to the structure and by varying expansions and contractions set up the stresses that make for maintenance. These uneven temperatures stress the seams and adjacent plate, facilitating corrosion in the form of grooving and pitting. Lack of water circulation has caused much grooving of flues near the front flue sheet and shortens general life and loss of locomotive serviceability.

It is quite likely that very much of locomotive boiler maintenance is caused by the effect of these irregular temperatures when locomotives are taken in, fires dumped, water and steam blown out, cold water washing and filling, firing up. Each of the foregoing items might be profitably considered, but time permits only of the last one, firing up.

Consider the water to be cold or even 150 degrees. Tests of staybolt movement prove that the firebox sheets begin to expand with the first bit of fire on the grate and accumulates to a very appreciable degree during the period of warming up before any steam is made. During this time there is no circula-

tion of account, the outer or wrapper sheet stays cold or at the original temperature. The firebox sheet expanding tends to give the staybolts an angular position. This is resisted by the bolts which act as a series of levers and produce a buckle of the sheet between each row of bolts. The outer sheet being generally heavier, resists the leverage action of the bolts, and the latter if of the rigid type, register the stress close to the outer sheet with perhaps a slight check; which, many times repeated, brings on a progressive fracture.

When steam is raised and circulation gradually started, some heat is then given to the outer sheet, which expands it and tends to reduce the staybolt angularity and in doing so, may add a check to the other side, of the bolt for its share of the progressive fracture.

This angular stressing not only leads to progressive fracture of the bolt at the outer end but also to grooving inside the firebox end, and the sheet buckling during firing up period may be followed by the cracks originating at the staybolt holes. The natural circulation in the water legs is upward against the hot sheet, downward against the cold sheet, with a neutral zone between. A stimulated upward circulation beginning early in the process of firing up would correct these irregularities and results of breakage and corrosion, both in sheets and staybolts of firebox legs.

In the flue section of an ordinary locomotive type boiler, the sluggish natural circulation expedites pitting and corrosion, due to the causes as set forth by the writers.

Circulation of boiler water is the result of temperature and gravity. When we consider that water at the boiling point or 212° Fah. is 2½ lbs. lighter per cubic foot than when at the standard temperature of 62° Fah., and when raised by further addition of heat to 388° Fah.: which corresponds to the temperature of steam at 200 lbs. pressure, there is a further reduction of 5 lbs. in the weight of a cubic ft. it is then easy to appreciate the force of the colder water in displacing that of higher temperature.

The feed water, particularly in the case of under water admission, sinks to the bottom quickly, imparting its quota of dissolved oxygen, to serve as the fuel supply for further corrosion. The flow of water backward to replace that evaporated by the firebox would be mainly from the bottom or heaviest layer, permitting more and more concentration in the higher layers enveloping the tubes and flues, expediting trouble.

The steam space above the water over the flue section partakes of the steam temperature, whatever it may be, dependent on the pressure. The water in the lower layer at the front end has been found by pyrometer tests to run 30 to 50 degrees lower and those variances in temperature produce stresses in the boiler structure which account for shell cracks, seam leakage, flue leakage, grooving and pitting. As one writer puts it: "Defective circulation and unequal strains in the boiler metal tend to promote local corrosion."

All this spells maintenance; in repairs, and renewals, due shortened life as well as a loss in serviceability of the locomotive.

A potent remedy for much of this has been suggested by a study of why a power house boiler operates with much less of inspection, repairs and renewals, and returning a greater percentage of service.

A vigorous circulation of the boiler water would reduce the range of temperature in the structure, insuring less need of repairs and prolonging life. Would reduce concentration and more thoroughly dilute deleterious elements as to their pitting and corrosive qualities. Would keep suspended matter in motion; so that instead of directly settling on flues and shell, it would be carried back to water legs for more convenient blowing off and washing.

There are other points of advantage in vigorous circulation of locomotive boiler water, but consistent treatment of the subject matter does not properly include such further discussion. It is believed, however, that to the six recommendations of the prize paper, should be added one or more, covering proper protection and operation of the boiler, to govern temperature stresses of the structure and to facilitate extraction or at least prompt dilution of deleterious elements in the feed water.

Doubtless there are other practical features in the care and operation of locomotives that are pertinent to ther life and serviceability and affecting in some degree the question at issue, such as treatment of the locomotive at ash pits and in housing, storing, etc., and a consistent thorough reading of the papers referred to will develop much information of value.

PRESIDENT: Mr. Seley, no doubt in the course of the evening there will be developed many questions, and I hope you will take note of all that is said and give us a resume at the end of the discussion.

Mr. Seley mentioned in his paper four prominent papers that were published in the Railway Review on this subject. We had hoped to have all the gentlemen who were authors of the papers mentioned, present tonight to enter into this discussion. We have been fairly successful. We have some of them with us and we have communications from others. Dr. Barr, consulting chemist of the Union Pacific System, sent his regrets, but will be glad to meet us here some time in the future and talk to us on this subject if we see fit to call on him. Mr. W. A. Pownall, Mechanical Engineer of the Wabash Railway, could not be with us, but has written some of his views on the subject and has also sent us a sample of a boiler tube which came from the front end of one of the locomotives on the Wabash Railway and from a good water district, not a pitting district at all. This flue shows evidence of grooving due, not to bad water, but to some other cause. This specimen will be on the desk and all who are interested may examine it after the meeting.

I will ask the Secretary to read Mr. Pownall's communication at this time.

WABASH RAILWAY COMPANY

Decatur, Ill., April 26, 1927.

Mr. G. W. Wildin,
Asst. Vice President,
Westinghouse Air Brake Co.,
Westinghouse Bldg.,
Pittsburgh, Pa.

Dear Sir:

I have your letter of April 21st, and while I appreciate very much your invitation, I find that I will be unable to be present at your Railway Club meeting Thursday night to listen to Mr. Seley on "Corrosion and Pitting in Locomotive Boilers."

This is a very important subject, and one in which I am sure there will be a great deal of interest displayed at your meeting, and I would certainly like to be there to listen to the discussion and possibly take part in it.

At the same time I received your letter I received a piece of flue taken from the front end of the flue in a 2-10-2 type engine, and which shows very plainly the grooving action of flue next to the front flue sheet. I sent this piece of flue to you as I thought it might be of interest at this meeting. I will say that this type of pitting occurs on districts where we have no pitting whatever in the rest of the boiler, and we have attributed

it to electrolytic action between flue sheet and the flue, contributed to very largely by the almost absence of circulation of water near the front flue sheet. Mr. Seley dwells somewhat on the advantage of vigorous circulation in the boiler. I think this is something to which we can well devote considerable thought. I am not prepared to say that increased circulation of water in the boiler will cure the pitting evil, but I cannot help but feel that the almost entire absence of pitting on the water side of arch flues where circulation is very rapid, whereas the other flues in the same boiler pit badly, is an indication of results that might be obtained in the balance of the boiler by any stimulant to circulation. When I say there is no pitting on the water side of arch tubes, I am going entirely on my own observations and results of inquiries from others, where it may be that in some districts the arch flues do pit on the water side. Circulation in the modern locomotive boiler is by no means poor, but if it could be speeded up considerably, particularly through the body of the flues it seems very probable that there should be a worth while reduction in the damage done by pitting. A number of the remedies that have been suggested for reducing pitting have either been expensive or impractical of general application whereas whatever device or form of boiler construction that may be used to produce increased circulation would probably not be of prohibitive cost, and would not be attended with operating difficulties such as the increased foaming trouble that goes along with the high-alkalinity-in-the-water remedy for pitting.

I have been unable to subscribe to the oxygen theory of pitting in boilers as it would seem that the surging of the boiler water and the rapid carrying off of the oxygen with the steam evaporated would prevent any undue effect of the oxygen, although where the oxygen is confined, as in the front boiler of the Mallet engines, there is no question but what it is largely responsible for the pitting experienced in that type of boiler. However, even though we have no pitting in water that contains plenty of dissolved oxygen, it is not improbable that the oxygen in combination with other elements in the water may contribute largely to the pitting. This is expressed quite well by the A. R. E. A. Sub-Committee on pitting, "The opinion still prevails that oxygen plays an important part in pitting and corrosion, not as a primary cause but as a phase in the cycle consisting in the removal of ionic iron from the water in the boiler, thus disturbing the equilibrium and permit-

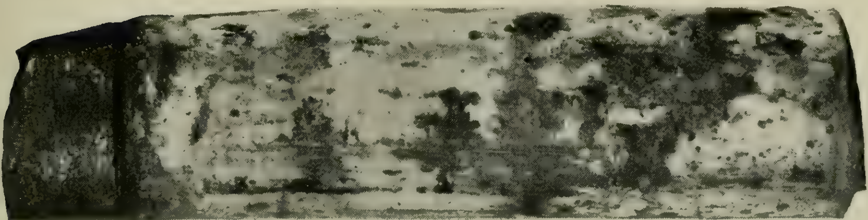
ting further attacks on the boiler metals by any corrosive agent in the water."

I have just been reading over some of the various reports of Committees that have devoted their time to this subject, and was much impressed by the excellence of the work that has been done thus far. The annual loss to the railroads as result of pitting and corrosion is tremendous, and it seems as though there is justification for some organization appointing somebody to devote his entire time to this problem for several years to correlate the valuable work of existing committees, and carry the problem out to conclusion. This might be considered less practical than having one man on each railroad that has serious trouble from the pitting standpoint, but whereas there are now plenty of competent officers handling the water treatment problem, their duties are usually manifold, and they cannot, therefore, devote their entire time to this one problem. The water treatment, of course, plays an important part in at least partially reducing pitting troubles, and I want to emphasize Dr. Barr's Sixth recommendation, which he considers most important of all, and that is to provide competent supervision of water treatment.

Yours very truly,

W. A. POWNALL,

Mechanical Engineer.



Front end of flue taken from 2-10-2 type engine, Wabash Railway Co., flues 23 feet long and locomotive operating in a non-pitting district.

PRESIDENT: Mr. F. N. Speller, Metallurgical Engineer of the National Tube Company, who was mentioned in the author's paper, is unable to be with us tonight but he has kindly presented some data prepared by him upon the subject and to be delivered by his assistant, Mr. H. R. Redington, which will enable those who want to follow him through the discussion, to pick up the points as he goes along. I have pleasure in introducing to you Mr. Redington.

MR. H. R. REDINGTON: Mr. Speller is very sorry not to be able to attend this meeting in view of the meeting in Chicago this week. This outline is somewhat of a departure from the usual method of handling this sort of a subject, but it is done primarily to bring out the points which the Committee have had called to their attention for consideration, and those points, together with the points that will be brought out in Mr. Speller's brief written comment on the previous paper, we hope will serve for a practical discussion of these points for you men at this meeting. I am very sure Mr. Speller would be glad again in turn to discuss any of the points that are of interest to this group of men, before the meeting in Chicago.

DISCUSSION OF PAPER ON "CORROSION AND PITTING IN LOCOMOTIVE BOILERS"

Contributed by Mr. F. N. Speller

The author of the paper has rendered a distinct service in summarizing the main points brought out in the symposium on boiler corrosion which was conducted last year by the American Water Works Association and the Railway Review.

While it is now generally agreed that corrosion is electro-chemical in nature and the main factors involved are probably known there is quite a difference of opinion as to the relative importance of these controlling factors. This difference in point of view is natural when it is considered how little experimental work has been done on this important subject. The writer will first discuss the main points having to do with boiler corrosion and pitting in order of importance as he sees the problem at present and will then refer to the movement which is now under foot to centralize the study of boiler corrosion problems.

The more important protective measures which have been proved effective may be summarized as follows:

I. The quality of boiler water should be under the supervision of a skilled industrial water chemist who would have charge of the control of the quality and who should make check tests of the corrosive action of the water by test specimens inserted in the boiler itself. In that way it may be possible to determine the effect of treatment on the actual rate of corrosion under service conditions.

II. The free oxygen in the boiler water should be reduced to such a point that it will give minimum corrosion consistent with the practical operation of the boiler.

III. The hydroxide alkalinity of the water in the boiler has a pronounced influence on the rate of corrosion depending to a large extent on the amount of free oxygen present. If the alkalinity is up around 9 or 10 grains per gallon no attention need be paid to the free oxygen but with lower alkalinity the oxygen should be reduced in proportion. Usually an oxygen content of not over 1 c.c. per liter (1.4 p.p.m.) is sufficiently low to keep corrosion down to a negligible point.

IV. The concentration of scale-forming salts should be kept under proper control by water treatment and a proper amount of blowing down so as to deposit a thin protective scale. On the first filling of a new boiler the water should be treated above the usual requirement with lime or other suitable chemicals so as to deposit a thin protective scale before corrosion has a chance to get under way.

V. Internal strains as a result of fabrication of the boiler material and strains resulting from irregular heating should be avoided as there is a decided difference in potential between overstressed and normal metal. Dissimilar metals in contact tend to accelerate corrosion of the one that happens to be the anode but if a scale is deposited this effect is usually negligible.

VI. Mr. Seley does well to call attention to the importance of circulation in the boiler. Any difference in temperature or in concentration of the boiler water tends to start electric currents from one part of the boiler to another and this is nothing but local electrolysis. The amount of metal carried into solution by such currents is directly proportional to the current flowing. In the case of a difference in concentration the current flows from the metal in contact with the more dilute to the metal in contact with the more concentrated solution. The depth of the pit holes depends mainly upon the size of the area from which the metal is being carried into solution. If the area is small, the pit is usually proportionately deeper.

VII. In this class the writer would put the selection of boiler materials. On this point the writer's opinion differs from the arrangement in which Mr. Seley and some others have placed these factors. It is not to be understood that boiler materials are of no importance but relative to factors external to the metal the writer believes that it has been thoroughly demonstrated that the boiler material is a secondary consideration. The material should of course be of

the best available and well adapted for the purpose but, such material has been used for many years without producing a noticeable reduction in the rate of corrosion or pitting and comparative tests indicate practically no difference in various kinds of water between the grades of steel which are generally available. A steel with 14 to 18 per cent of chromium would undoubtedly last much longer but would be rather difficult to work and prohibitive in cost at the present time. Such steels (classed as stainless) have a rate of corrosion less than 1/10th that of ordinary steel immersed in water and under other conditions the resistance to corrosion is much greater than this.

Mr. Seley refers to the general adoption of the electrochemical theory but seems to intimate that the presence of oxygen is another factor whereas the electrochemical theory was mainly formulated as an explanation of the well-known action of oxygen in accelerating corrosion. It is a curious fact that the parts of the metal which are best protected from oxygen such as in crevices or the bottom of a pit hole are most subject to corrosion. The electrochemical theory explains this and has been checked experimentally. In other words if we have two pieces of the same steel immersed in water carrying a small amount of a dissolved salt and connected externally by means of a wire and then pass a stream of air over one of these pieces in such a way that the air will not come in contact with the other; a current flows from the piece that is not aerated to the other one which is aerated and corrosion follows in the same direction.

The writer was glad to see a reference to the very general but objectionable practice of introducing the feed water below the water line. He has frequently called attention to this very undesirable condition. There are devices in use with stationary boilers which will hold the feed water near the water line in the boiler until it has been heated to about the temperature of the boiler water. The gases are discharged into the steam space and the water then overflows. With such a device an open heater may not be necessary especially if the water is preheated in a closed heater or by means of an oversized injector. Heaters have apparently shown decidedly good results in reducing the rate of corrosion in boilers probably due to the fact that the water is introduced into the boiler hot and thus permits the discharge of most of the oxygen before it is carried downwards. The best combination would seem to be a heater which will discharge at least part of the gases

and then an overflow device which will retain the feed water at or near the water line until at least 90 per cent of the dissolved oxygen has been thrown off into the steam space.

The problems which require further experimental work are included in the following list, arranged according to their relative importance:

1. As most of the laboratory experimental work should be conducted at boiler temperatures ranging from 250 to 450°F. a study should be made of a convenient form of experimental boiler of suitable and safe design and construction for this purpose.

2. Determine corrosion rate and hydrogen gas evolution in absence of oxygen at pH 6 to 10 at temperature range 250 to 450°F. with distilled water and with typical non-scale-forming treated boiler waters.

3. Relative corrosion rate in common salt solutions (sulphates and chlorides) of various concentrations at pH 6 to 10. A standard grade of flange quality boiler steel should be selected and kept for these tests. (The natural change of pH with temperature should be taken into account and a plot made for reference).

4. Study formation of protective films deposited from water at boiler temperature in presence of variable amounts of soluble salts up to concentrations commonly found in practice.

5. Generation of organic corrosive compounds (organic acids); influence of sewage contamination; possibility of oxygen being generated from organic compounds.

6. Relation between potentials of different metals at pH 6 to 10 and at temperatures 250 to 450°F. in typical boiler waters.

7. Electrothermic effects in boiler water carrying saline matter as affecting corrosion of tubes and other vulnerable parts.

8. Effect of O_2, CO_2 and low concentration of salts on corrosive or erosive action of steam.

9. Influence of boiler scale in causing pitting, particularly underneath scale.

10. Electrolytic prevention—cause and effect.

11. A method for testing relative corrosion of metals under boiler conditions with free oxygen, pH and other factors under control.

This list of problems has been prepared by the Joint Committee on Boiler Feed Water Corrosion sponsored by the

American Water Works Association with the co-operation of the American Railway Engineering Association, American Society for Testing Materials, National Electric Light Association, American Society of Mechanical Engineers, and American Boiler Manufacturers' Association. No work has been done as yet as the committee has only been organized for a few months and will require some funds in order to build and equip a small experimental boiler where all these conditions can be kept under close control and to secure the services of an investigator who will devote his entire time to this study. Any suggestions that the members of the Railway Club of Pittsburgh have to offer in regard to this co-operative investigation will be appreciated by the committee.

OUTLINE

DISCUSSION BY F. N. SPELLER OF PAPER BY C. A. SELEY ON "CORROSION AND PITTING IN LOCOMOTIVE BOILERS"

Agreement as to theory but some difference as to relative importance of controlling factors.

Summary of protective measures in order of importance:

1. Quality of water (a) Control.
   (b) Check Tests.
2. Free Oxygen.
3. Hydroxide Alkalinity—Amount needed depends on free oxygen present.
4. Concentration of Scale forming salts (controlled by (a) water treatment (b) Blowing down).
5. Internal strains (a) care in fabrication.
6. Circulation in boiler (a) Difference in temperature.
   (b) Difference in concentration.
7. Boiler material.
   (a) Uniformity and surface finish important but actual life depends on factors external to metal.
   (b) Tests show little difference between various grades of steel now in use.
   (c) Possibility of alloy steel.
   (d) Importance of Oxygen elimination (importance of delivering feed water above water line.

Centralized study of problems.

Suggestions for further experimental work by Joint Committee on Boiler Corrosion.

1. Need for experimental boiler for study of temperatures between 250 and 450°F.
2. Determine corrosion rate in absence of oxygen.
3. Determine corrosion rate in salt solutions.
4. Study formation of protective films in boilers.
5. Internal strains (a) care in fabrication.
6. Study relation of potentials of different metals in boiler water.
7. Electrothermic effects due to temperature variations.
8. Effect of O_2 and CO_2 on corrosive or erosive action of steam.
9. Influence of scale.
10. Electrolytic prevention.
11. Testing with certain factors under control.

Proposed work of the Joint Committee.

PRESIDENT: Our next speaker has come a long way to discuss this paper. You may rest assured that men are interested when they will come the distance he has to take part in the discussion of a paper of this kind. I take pleasure in introducing Mr. L. O. Gunderson, Chemical Engineer of the Chicago & Alton at Bloomington, Ill.

MR. L. O. GUNDERSON: My young years and experience perhaps need a explanation, in appearing in this capacity. It is an honor to be called upon here and I am glad to have come to your meeting. I feel that my work on corrosion and pitting got a good impetus under Dr. O. P. Watts at Wisconsin University and he made me feel that this was my problem to solve. I came here more for the floor discussion, but in order that I should not ramble too much I gathered a few notes this afternoon, which, if you will pardon the lack of preparation, I will read.

CORROSION AND PITTING OF LOCOMOTIVE BOILERS

Discussion by Mr. L. O. Gunderson, Chemical Engineer, Chicago & Alton Railroad Co., Bloomington, Ill.

The paper just presented reviews six recommendations with which Dr. Barr of the Union Pacific closes his article on corrosion in the Railway Review, issue of June 5, 1926. No one will question that emphasizing these recommendations, and calling attention to work that has been done on the problem of corrosion, is fully justified in view of our very present problem of pitting and corrosion in locomotive boilers. To these recommendations, very appropriately, could be added Mr. Seley's additional ones covering reduction of stress due to thermal differences by creating better circulation of the boiler water, and by providing for more expeditious removal of dissolved gases, notably oxygen.

However the experience of many investigators will verify the conclusion I am now to draw, viz., that, granting that practical perfection is reached in all these recommendations excepting two, carrying high caustic treatment and removing oxygen, we should still have destructive pitting of tubes and fire boxes. Incidently, these points are at the same time most difficult of attainment in locomotive practice. I mean by this statement that herein lies the real causes of corrosion or pitting —the hydrogen ion concentration and the oxygen. The high caustic treatment is designed to cut down the hydrogen ion

concentration, and the higher the oxygen content of the feed water is, the greater will be the required caustic alkalinity. It follows then conversely that if these two factors are controlled within certain limits that no pitting could take place irrespective of failure to comply with the other recommendations. If the hydrogen ion concentration and the oxygen content of the feed water are favorable for corrosion then the other recommendations become of importance only as alleviating measures, with no hope for the prevention of the pitting process.

I find that Mr. F. N. Speller of your city in his article printed in the Railway Review, September 11, 1926 issue, has most ably discussed this phaze of possible pitting prevention. He contends that pitting can be prevented by excess treatment with caustic soda, provided the dissolved oxygen content is reduced sufficiently, depending on local conditions, usually to at least below one cubic centimeter per liter. In locomotive practice the residual oxygen in the boiler water is such that the required caustic soda excess to prevent pitting is so great that it would cause serious foaming trouble.

I have attempted on the Chicago and Alton Railroad to carry the highest possible caustic alkalinity, up to 50 per cent of the total dissolved solids, but from a practical standpoint no reduction of pitting was noted over the previous period of ordinary treatment. This adverse showing I attribute to the dissolved oxygen content of our many pond and river waters.

On the other hand at our main terminal, Bloomington, Illinois, where the tubes in our yard engines fail from pitting in eleven or twelve months, we have absolutely stopped all pitting and corosion in the power house boilers by carrying a high caustic alkalinity in connection with a feed water heater which removes enough oxygen to prevent corrosion. The excess caustic alkalinity that could be carried in these yard engines was not sufficient to reduce the pitting troubles.

However, my principle work on corrosion prevention centers on a "counter-current" system, similar to the so-called Cumberland process, but different in one all-important respect, which is an added provision for preventing local galvanic couples which result in pits. Mr. Evans, an English investigator, and Mr. Speller have both stated that a metal surface acting as a whole as a cathode ("as the boiler heating surfaces in the Cumberland process") does not prevent local galvanic action on its surface. I have for several years felt that therein lay

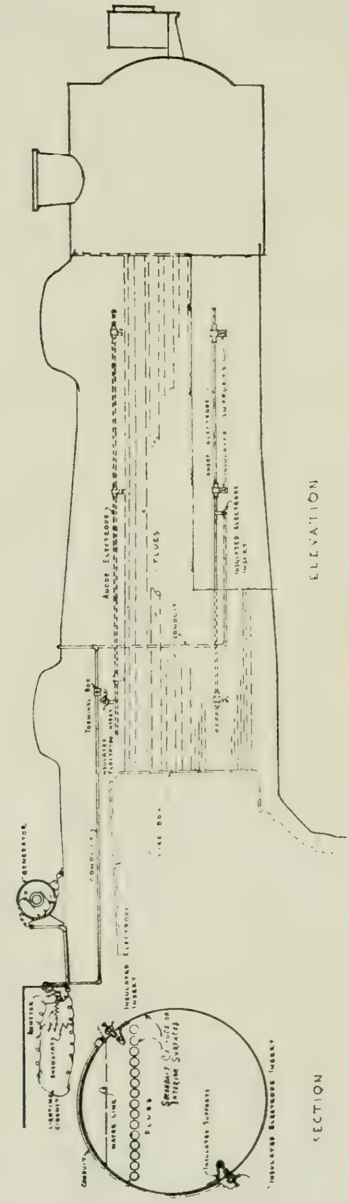
the reason for the failure of the Cumberland process applied to boilers for pitting prevention.

To stop the local couples or pits I conceived the idea of polarizing these galvanic couples by plating out a metal with a high over-voltage of hydrogen, that is a metal having a high discharge potential of hydrogen. Such a metal is arsenic. The plating of arsenic alone would inhibit pitting if there were no depolarization, but in the locomotive boiler fed with water saturated with oxygen it becomes necessary to prevent this depolarization and maintain the effectiveness of the arsenic. The counter current does this by plating out at all times when engine is in service sufficient hydrogen to combine with all the oxygen that comes in contact with the boiler metal, besides supplying an excess of hydrogen to keep a permanent polarization of the pits.

The current in the Electrolytic Polarization System I use does three things which account for its effectiveness: First, it plates out hydrogen on the metal surfaces which in combination with the arsenic plating maintains a permanent polarization of the galvanic couples, or pits; second, it plates out hydrogen in excess on the surface of tubes and sheets which combines with any oxygen in the water in proximity to heating surfaces to form water, which oxygen would otherwise be used in carrying on the corrosion reaction; thirdly, in plating out and evolving hydrogen (electrolyzing water) at the surface of the boiler metal it leaves the OH or hydroxyl group behind in excess, perhaps only in molecular thickness film, but nevertheless this hydroxyl group will precipitate a small amount of calcium carbonate dissolved in the water onto the flues which eventually builds up a thin but impervious and dense coating which is a protection against corrosion.

We have tried this on several locomotives for four or five years. The installation consists of electrodes inserted in the boiler insulated from the boiler metal. I used wrought iron 1″ double strength pipe extending through the length of the boiler insulated from the shell. The current is passed by insulating plugs to these electrodes and the current is derived from a shunt from a generator which passes a current of 2000th to 3000th of an ampere per square foot of heating surface. The first year we applied one electrode in the top of the boiler. We found the protection was not extended to the bottom part of the boiler and we realized that one electrode was insufficient, so we put an electrode in the bottom and one

in the top of the boiler, and when it was next shopped in 18 months the fire box was exactly as it was before electrodes were installed. The second installation we took out last November. The tubes were reapplied, having been saved from pitting and corrosion after 20 months service in our worst

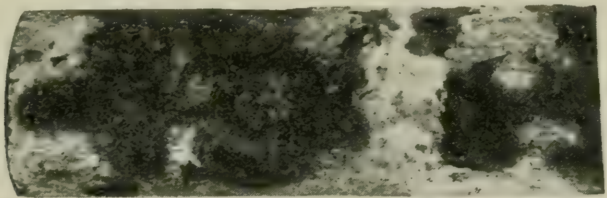


·ELECTROLYTIC POLARIZATION SYSTEM·
FOR THE
·PREVENTION OF CORROSION AND PITTING·

pitting water territory. Several months ago we invited several interested parties from other roads to be present when the electrode equipped locomotives were opened for inspection, and we found that the pitting was absolutely prevented in these boilers. Another engine running opposite it, after 12 months service required removal of flues, and fully one-third of these had to be scrapped on account of pitting.

The electrolytic system as applied to locomotives on the Chicago and Alton Railroad has thus been proven successful in inhibiting pitting and corrosion of boiler tubes, sheets and stay bolts. The system commends itself as being of universal application irrespective of the character of the water.

I have here a piece of a boiler tube removed from a yard engine using one of our worst pitting waters; you will notice the pitting is very bad, one of the pits having pierced the tube. This condition developed in 12 months of service. This other piece of tube is in perfect condition, representing a tube that had seen 18 months service in the same water and in the same engine after electrodes had been installed. All contemporary power in these yards continue to develope flue failures from pitting in less than twelve months. In this locomotive, as in three others in passenger service in pitting districts, the pitting and grooving of the tubes and the fire box and shell has been definitely terminated.



Section of tube removed from yard engine after 12 months service, one of the pieces referred to.

The reason for the success of this system over the failure of the Cumberland process to give protection from pitting, I attribute to the electrolytic polarization of the galvanic couples which cause pits. This is accomplished by plating out the arsenic to act as a secondary cathode. The function of the arsenic is to prevent the iron from displacing hydrogen from solution without which no pitting can take place. The current also causes a dense coating of calcite over the surface of the flue which also protects the tube to a great extent. The

one outstanding fact therefore that is worthy of your investigation is this, that the electrolytic polarization system of pitting prevention as installed and operated on the Chicago and Alton Railroad has stopped pitting and corrosion in boilers so equipped.

PRESIDENT: We have with us a gentleman whose duties carry him throughout the western part of Pennsylvania and the eastern part of Ohio, his full time being given to the examination of boilers of various kinds, I take pleasure in calling on Mr. J. A. Snyder, Chief Inspector, Hartford Steam Boiler Inspection and Insurance Company.

MR. J. A. SNYDER: Mr. Chairman and Gentlemen: I came here this evening to be a very good listener. I have not much to say in connection with these speakers this evening but I am very much interested in the subject because we are inspecting many boilers in this district. And I agree with the speakers in regard to feeding in the steam space and also on the question of circulation because we find where there is poor circulation in any boiler, locomotive or stationary, there is a tendency to pit or corrode. We find it in very modern boilers. I think you have speakers here who have come prepared to talk on this important subject and I will give way to them, and, as I say, be a very good listener. I thank you.

PRESIDENT: When I found out what the subject of this evening's paper was to be I thought I would call on my old friend Colonel Milliken to talk. I wrote him a letter and he shifted the buck to one of his assistants, so we have with us to discuss this subject for him Mr. C E. Betz, Chief Chemist of the Pittsburgh Testing Laboratory, Pittsburgh, Pa., whom I am pleased to introduce to you.

MR. C. E. BETZ: I find that I am more or less of a stranger in this group and while I have been extremely interested in the papers and the discussion that has followed, I do not feel qualified to take a very important part in the discussion. Mr. Seley's paper and Mr. Speller's, very ably cover the theoretical side of it and Mr. Gunderson's report of his results in specific cases has certainly been interesting. This whole problem of corrosion is such a large one that a chemist, such as I am, looks at it with at least a whole lot of respect. It is only within comparatively recent years that research has been focusing attention on an active attempt to solve the corrosion

problem, not only as related to boilers but in its innumerable other phases. Nearly all metals are subject to corrosion and it involves a tremendous loss which conceivably can be prevented.

As regards its application to locomotive boilers and boilers in general, there seems to be no doubt that locomotive boilers are subject to special ills that do not occur, at least not so markedly, in the case of stationary installations. Nevertheless there are certain general principles which research work has brought to the front, notably the ionic theory of corrosion, that perhaps comes into the solution of all of them. The connection of the Pittsburgh Testing Laboratory with the corrosion problems is more that of a doctor. We are often confronted with specific instances of corrosion which we are asked to explain, and I am impressed with the fact that no two cases appear to be alike. Things which seem to be controlling or determining in one instance, such as bad feed water, in another instance do not seem to apply. Too often an operator confronted with a case of corrosion will attempt to pass the blame on to what he calls defective material. Another man will say the trouble is with the water. In many such cases examinations in the laboratory have shown that the tubes were of very high commercial quality and still pitting occurred. Or the water was what might have been considered ideal water for boiler feed purposes, and pitting went on in spite of this. I have in mind one case, it was a stationary installation, where the tubes were brought to us badly pitted and absolutely free from scale. The feed water was practically of zero hardness. The engineers could not understand why, with such a good plant and water in such good condition, they still had pitting. It developed that the oxygen concentration in this particular feed water was exceptionally high. There seems to be no doubt that that was responsible for the corrosion. There was a case where perhaps the water was too good.

I think Mr. Speller mentioned the thin coating of protective scale. A little bit of scale is oftentimes a good thing. But you do not want very much of it for it cuts down heat transfer. But a little bit of scale will often be a protection to the metal underneath. Although one of the necessary conditions of this little bit of scale is that it must be unbroken, an unbroken deposit, because at points where the water can get underneath you begin to have pitting.

I agree with the speakers so far, as to the value of the removal of oxygen from feed water by whatever means is

possible. In stationary installations it can be done with an open feed water heater or a de-aerator. In the case of locomotive boilers that is not so readily done. Perhaps the introduction of the feed water above the water line may be the method of controlling this factor. It does seem to me though that the sixth suggestion, as Dr. Barr has said in his paper, is the most important one of the lot, and that is that the handling of the corrosion problems, water softening, etc., in any boiler plant be in the hands of a trained man who is capable of intelligently applying some of these lessons which we have learned from the research chemists as to the reasons for corrosion. Just as in fighting any human disease, once the reasons are known and understood the cure seems to follow almost automatically.

PRESIDENT: In looking over the audience a few moments ago I recognized an old friend and associate of mine who used to bring this subject to my attention when I was Mechanical Superintendent of the Erie Railroad. He is just as enthusiastic tonight as he was 20 years ago when he brought his problems to me. We will be glad to hear from Mr. W. B. Landin, Chief Chemist of the Erie Railroad, Meadville, Pa.

MR. W. B. LANDIN: Water is the greatest and most important of all raw materials. No industry can operate without using water. It has been estimated that three hundred and fifty billion gallons of water are used annually by the railroads of the United States for locomotive purposes, of which about 80 per cent could be improved by treatment.

The Erie Railroad Company estimated that it treated over one billion five hundred million gallons of water in the year 1926 to render same satisfactory for locomotive purposes. The treatment was principally for the prevention of scale, but as heavily scaled boiler sheets and tubes are also liable to corrosion and pitting by over-heating of the metal and liberation of acids from chemical reaction of the ingredients in the scale, incidentally the treatment also prevented corrosion.

We are living in a day when new light is being thrown on old subjects. Corrosion has always been a destroyer of iron and steel, and ages rolled around with no apparent remedy in sight. The loss of iron and steel by corrosion is startling. With a boiler, it is not so much the amount of metal lost by corrosion and pitting, but the effect on the operation of the locomotive, and also the cost of replacement of boilers whose

life have been shortened by corrosion and pitting in some of its parts.

The paper read, states several causes for corrosion and pitting:

(1) Boiler metal not having a uniform and constant composition brings about electro-potential differences, and this in the presence of an electrolyte in the form of a solution of salts in the boiler causes corrosion or pitting to take place.

(2) Strains in the metal due to improper annealing or working of the metal.

(3) Incrusting solids forming hard scale on the sheets and tubes, tend to overheating the metal, which is an aid to corrosion.

(4) Oxygen and other gases in the water assist the corrosion and pitting.

(5) The concentration of the dissolved salts tend to corrosion and pitting by making the water a better electrolyte.

(6) Defective circulation adds to the corrosion tendencies.

The paper consequently has given a splendid diagnosis of the corrosion and pitting trouble, and when same occurs remedies can be applied as indicated by the diagnosis.

The Erie Railroad has very little trouble from corrosion or pitting in the hard water territory since the water has been treated, and only isolated cases of corrosion or pitting in the good water territory, which takes place at points where switch engines used a grade of water, which is very soft, containing in the neighborhood of two or three grains of incrusting solids per gallon.

The treatment of water in the hard water district has prevented corrosion and pitting:

(1) Because the treatment removes the hard scale, and produces a soft porous sludge—thus preventing overheating of the metal.

(2) Because of the alkalinity produced—thus neutralizing any acids or acid salts.

PRESIDENT: I think we are getting the subject pretty well discussed. We have had some splendid talks and I am now going to throw the subject open for general discussion. I hope the members will feel free to ask such questions or

make such suggestions as they may see fit, and do it as briefly as possible because our time is growing short.

COLONEL JAMES MILLIKEN: Our Chairman always likes to rag one. He asked me to be prepared to discuss Mr. Seley's paper and I told him that I would be glad to do so if it were possible. At that time not being sure of this possibility I was glad to assign Mr. C. E. Betz, our Chief Chemist, who would, I knew, discuss a technical paper of this kind better than I.

One of my early recollections as a railroad man was the causes that led to the pitting and buckling of firebox sheets. The best methods of making either entire renewals or in half-soling them. The early practice as you will recall in half-soling or patching was with the use of patch bolts; later oxy-acetylene and electric welding proved most successful.

I am rather surprised to find that the discussion this evening has turned more to the pitting of tubes than to the fire-boxes, which means that the pitting occurs really at the point where there is the least amount of circulation of water rather than at the greatest.

Mr. Seley has had a wide experience not only in boiler construction and operation but in devices to increase circulation of water throughout the entire boiler. I believe it would be most interesting to all of us if he would tell us something of his accomplishments in that respect, and whether or not this increased acceleration of water has been a benefit in preserving the boiler sheets as well as in increasing the efficiency of the boiler. If he has any facts or figures with him I am sure that we will be glad to hear them.

PRESIDENT: Does any one else have anything to add? I did not think the discussion would be so short when I threw it open for a free for all discussion. Professor Endsley, are you going to get up or shall I have to call on you?

PROF. LOUIS E. ENDSLEY: This is a case where doctors do not agree and I am not one of the doctors. You know I have a remedy for this oxygen in the water. It would be easy to fill the tanks full of gold fish and they will eat all the oxygen out in no time.

But seriously, this outline at the bottom of this paper of what the committee hope to do makes me think that it is about time for somebody to do it. And that is the way to

really get at a subject of this kind. From what I have heard tonight about the pitting of flues in 12 to 18 months, it would seem that we ought to have a lot of money to do research work on that subject, if we could save one-tenth.

I have enjoyed the paper very much and it has been a substantial contribution to this society.

MR. HERBERT LEWIS: I cannot help but think like Professor Endsley. I am a railroad man having had some 30 years experience before going into the R. R. Supply business, and I have had considerable experience with these water problems. When I was in the railroad service over in the state of New York some 20 years or more ago, we had to remove flues from locomotive boilers operating in certain districts, in seven months time due to heavy scaling conditions. I have also inspected boilers in other localities where no scale trouble existed, but the flues were found badly pitted.

It occurs to me that Professor Endsley's question as to why we did not get at it earlier, is answered by the fact, as every one of you older men know, that for years and years in the railroad service we have all been struggling with this water problem. We have been willing to try anything that came along, like a drowning man grabbing at a straw.

I remember some years ago, when I was General Boiler Inspector for the New York, Ontario and Western Railroad Co. Mr. George West, then Superintendent Motive Power of that system requested me to try out a certain compound that was highly recommended as a sure scale remover. We put it in, and it did remove the scale all right, but it set every rivet, every seam and every joint in the boiler leaking so badly that we had to take the locomotive out of service in two weeks time. The cure was worse than the disease.

Many of you have no doubt had similar experiences, but we are now living in an age wherein the root of the trouble is being revealed, and I think the problem is nearer solution.

In answer to Professor Endsley as to "Why don't somebody do it," I think actions will speak plainer than words and that before very long the situation will be pretty well under control.

During my 10 or 12 years as a federal inspector of locomotives this water problem was brought most forceably to my attention, particularly regarding the Marion, Ohio, locality of which you have just heard the gentleman from the Erie Rail-

road Company refer to, and this recalls to my mind a conversation between Mr. Jackson, now Superintendent Motor Power of the Erie Railroad and myself at Youngstown, Ohio. Mr. Jackson referred to the Marion water problem in the same terms that General Sherman referred to war; and you all know what that was.

Whenever and wherever this water question is discussed with railroad men, the universal opinion is to the effect that 50 per cent of the grief would be eliminated if the feed water problem could be solved, and we are today, more hopeful and more confident than ever before, that through scientific investigation and chemical research work, these water troubles will be reduced to the minimum in the near future.

There is one question I would like to ask Mr. Gunderson, whose talk was certainly most interesting.

If I remember right, he stated that the piece of flue exhibited on the table was removed from a locomotive boiler using water having been treated with soda ash, which treatment removed most of the scale, but, some pitting was in evidence. I would like to ask if that water contained a high acid content when they used the soda ash and, if so, what percent of soda ash was used to get away from the acid condition.

MR. L. O. GUNDERSON: Previous to this time there was no acid water, it was simply high in sulphates and carbonates of magnesium and calcium. Our trouble was excessive scale formation. Scale ¼″ thick would form in about 10 months. We use soda ash alone with success. The water is treated at every water station. Some waters require as high as 5.6 pounds of soda ash per 1000 gallons to prevent scale formation. At present we are using 4½ pounds of soda ash per 1000 gallons at Bloomington, Illinois, to maintain an excess treatment of 70 to 80 parts per million of sodium carbonate in the treated water, which gives us no foaming trouble as long as this excess treatment is maintained and the boilers are consistantly blown. Our reason for treatment therefore was not to neutralize any acid but to prevent scale formation. When we did remove scale and prevent formation of new scale then we had pitting of boilers to contend with.

MR. A. E. ANDERSON: A couple of questions. I did prepare a little historic material but I will not use it tonight. When Mr. Seley discussed the question of circulation in a boiler I tried to imagine what was going on inside the boiler,

and I was a little surprised that there should be any question of circulation. With the large volume traveling at the great speed of a locomotive as compared with a stationary boiler, the locomotive is always on the jump and whirl and the water is in a continual state of agitation. The question in my mind is what effect that agitation has upon this question of circulation, and the necessity for circulation.

The other question relates to a point I have had in mind for a number of years and that is the question of oxygen as affecting the condition of the steel in the boiler. Oxygen has a great affinity for electricity, that it is is a good conductor. The earth is said to be made up of more than one-half oxygen in various forms and combinations. With the intimate relation of oxygen and electricity, and with the earth one-half oxygen, there may be some explanation of what we call the law of gravitation, for scientists have found out that the action of what we call electricity is practically the same as the action of what we call the law of gravitation. Therefore with this question of the oxygen in the water and its affinity for electricity, it carries out my notion somewhat that electric action has an action upon steel, therefore causing this corrosion and pitting. And this action in the boiler is very similar to the electric action that goes on every time there is a thunder storm. Therefore I would like to ask the questions as to circulation and as to electric action.

PRESIDENT: Mr. Seley I will give you a chance to close the discussion.

MR. SELEY: The locomotive boiler is a sort of chemical laboratory. Things go on in there that we are gradually finding out. A very interesting investigation was made on the C. & O., some years ago to discover the reason for the amount of pitting and corrosion they had, and an analysis of the boiler feed water at the water stations did not develop a thing. It happened to occur to somebody, as they were blowing out a boiler, to analyze that water and see what had happened, and they found sulphuric acid indications not at all in line with the original composition of the water which went into the tender. Furthermore they found that where there was an opportunity for excess of scale to form, there was an interruption to the heat transfer from the sheet to the water, heating up under the scale, and that had tended to decompose the inner surface of the scale, and that formed acid which was not

found in the original boiler water. So there are things happening all the time which can only be found by pretty close research.

I am very much pleased with Mr. Speller's contribution. I feel in a rather difficult position, not being a chemist but with entirely mechanical training, to translate the findings of these chemists in this matter. Mr. Pownall's remarks in his letter not accepting the oxygen statement altogether, I think is not difficult to understand. He does accept in his paper from which I quote, the electro-chemical theory. I would like to have the opportunity to read to you, one paragraph over again so you will understand, at least as I understand, what these chemists are trying to tell us as to what causes corrosion.

"The quoted writers are agreed upon the electro-chemical theory, and in analysis state that hydrogen ions dissociated through the salts or water is the corrosive agent, but the presence of oxygen in the water adds the fuel, so to speak, in the formation of iron oxide or rust, the visible corrosive evidence.

"This seems to be the gist of many paragraphs of the detail of the process of corrosion. It is evident therefore that oxygen, so useful in the firebox is very detrimental in the water, hence the recommendation to remove it."

I am also very much pleased with Mr. Gunderson's electrode theory. I do not know whether it will be generally adaptable on the railroads unless under talent such as Mr. Gunderson displays in this connection and which is not common on railroads.

In answering Mr. Anderson I would say there is a mixing up, a circulation of the water in the boiler, from two sources. One is, as I explained in my paper, the difference in the weight of cold and warm water. The heavier or cold water displaces the lighter or hotter water. But there is not sufficient movement or mixing up in the ordinary type of boiler construction. Where there is 30 to 50° difference in temperature between the bottom of the boiler and the steam temperature at the top, it puts stresses into the boiler structure that calls for maintenance. You can readily see that the top of the boiler is as hot as the steam. If the steam is 200 pounds the temperature is 388°. I know of one case where a pyrometer was put in the front belly plug of a locomotive in service for two hours on the road and showed an average of about 350°, 35 to 40 degrees below the steam temperature. I know a case

of an engine which was equipped with a circulating medium, being fired up along side of another that was not so equipped, and it got up 200 pounds of steam from 150° feed water temperature in 99 minutes. In the one that was not circulated it took 120 minutes, a saving of 17 per cent in time and 10 per cent in fuel for circulation. At the same time they had put a thermometer into the lower corner at the front of a side water leg, to see what was happening at the bottom of the boiler. In the case of the boiler that was not equipped with circulating medium, there was no increase in temperature at the bottom for 100 minutes. In the 20 minutes remaining that pyrometer showed about 260° or about 128 degrees less than the steam temperature.

The thermometer in the boiler which was equipped for circulation followed very soon after the steam was started. It lagged perhaps 10 to 15° but when it got up to 388°, temperature of 200 pounds of steam, the water at the bottom was 382°, showing a very complete circulation and a very small range of temperature.

I do not recall any other points except Mr. Milliken's request for something about the device to make the water circulate. You can get circulation by a pump of some sort, forcing a piston back and forth would put the water into circulation. It so happens in a locomotive firebox that you can take the water from the bottom of the boiler, which is cooler than the water at the top and have a separate vessel to heat it and discharge it over the crown sheet to get a similar action, a syphon action, because if water is heated and made lighter, it is followed up at once by the heavier or cooler water from the front, and changes the general scheme of the locomotive boiler circulation more in line with what you find in your water tube stationary. In this type of boiler, with an inclined bank of tubes and a drum at the top, you find a complete circulation through that system, and it attains a velocity of 16 to 20 feet a second in the tubes, consequently all the material in the structure of that boiler is at quite fairly constant temperature or at least with a very small range of temperature.

For locomotive boilers, we attain the same results by installing vertical water legs in the firebox and combustion chambers, known as Thermic Syphons.

These connect with the water in the lower part of the boiler shell, heating and conveying it to and over the crown sheet, whence it flows forward, due to water always seeking a

level, thus establishing a complete cycle of circulation of all the boiler water through the syphons several times an hour.

As to proof of the value of circulation of locomotive boiler water, much information has been gathered from various railroads and by our service men, of which some specific cases as well as general results might be cited. I shall not give the names of the roads, or the officials that have given the information, but I shall not give any information that cannot be verified from our files.

Here is a specific case in line with the information stated to your President by the mechanical engineer of the Wabash, as shown by this flue (showing flue on table.)

On one of our western roads, during October, 1923, three mountain type engines equipped with the ordinary arch tube arrangement were placed in operation, and during February, 1925, experienced trouble in the lower flues grooving just inside the front flue sheet, making it necessary to renew the lower rows of the flues after the engine had made 66,400 miles. In order to ascertain if it is possible to overcome this trouble by increased circulation; an engine syphon equipped, was transferred to the division in April, 1925; and after making 86,000 miles over the same territory, arrangements were made to remove a bottom flue on either side of the center to determine the amount of corrosion, and it was found that there was no indication of corrosion, the flues being in as good condition as when applied new. From the foregoing it would appear that increased circulation had entirely eliminated the trouble. In addition to this the firebox sheets were in very much better condition.

On another district of this same road comparative figures on flue life on types of otherwise similar locomotives is stated as follows: Mileage between shopping, 68,112 without syphons, and with syphons 101,618, an increase of 49 per cent.

Just before I left came a very recent report from one of our service engineers on this same railroad. He received information to the effect that on a syphon locomotive the flues had made the full term of four years, being removed on account of the Commission requirements, and the flues were still in good condition. The flues in their non-syphon locomotives are renewed every two years.

A little farther north and west, on another railroad, there are adverse water conditions which are described as follows: All the engines burn oil and they have a water containing 11

pounds of incrusting salts per 1000 gallons of water. In non-syphon locomotives there is a heavy accumulation of scale on the flues and back flue sheets. Necessary to frequently renew the flues in these engines. On account of stagnation and cold water in the bottom of water legs behind brick walls, which are necessary in oil burners, many staybolts break. These engines make 25,000 miles and the flues must then be removed and safe ended. Syphon locomotives in that territory made 36,000 flue miles and the flues are as clean as when put in service. The foreman said they would make 60,000 miles. There was only one broken staybolt in this engine. The foreman said the expense on the non-syphon firebox in one month was about equal to that on syphon engines in 12 months and that if his engines were all syphon equipped he could reduce his force at least one-half.

In 12 passenger type locomotives, on a long run out in that territory, after 18 months service, due to syphon induced circulation, the flues were clean and free from scale. During this time no maintenance work of any kind was required on syphons, flues and fireboxs. This is a remarkable record and one never approached in non-syphon locomotives in the same territory. In the lower central section of the country, figures were furnished by one large railroad. Eight non-syphon locomotives with 24″ cylinders made an average of 57,691 flue miles. During that mileage there was an average of 108 small flues and 4 superheater flues renewed on each locomotive. Six non-syphon locomotives with 22″ cylinders average 51,988 miles and when shopped to full set of 225 flues were renewed in each locomotive. Twenty syphon locomotives averaged 78,034 flue miles and only 64 small tubes and 3 superheater tubes were removed. A Pacific type locomotive made 25,000 miles without a flue being touched by a boiler maker.

Farther west and south, another road could not get more than one year's service out of flues in non-syphon locomotives. With syphon locomotives, they obtained 2½ years service.

From an eastern road with generally bad water conditions. The Master Mechanic stated that something happened inside the boiler after syphon application. All the flues were welded. After 60,000 miles the entire set of flues were removed and were found to be in excellent condition. They were safe ended and reapplied and he expected them to make an additional 60,000 miles. They have nothing like this record

in this district in the entire history of the railroad. With non-syphon locomotives the usual practice was to remove the flues and safe-end them after 35,000 miles and they would run an additional 20,000. In the non-syphon locomotives on this road considerable scale and mud was always found in the back half of the flues, which was undoubtedly the cause of flue leakage.

Another road in the same territory. It is our advice that syphons are having a very favorable effect on the flues. One was sent to the shop after 64,840 miles as compared with a maximum of 35,000 to 42,000 with non-syphon locomotives in the same territory. Reports very much less scale, surfaces almost entirely free from scale over almost the entire area.

So far I have talked mainly of the flues, which is the more susceptible part of the structure. Whatever will contribute to flue life and reduce maintenance will likewise assist in firebox life and reduce maintenance. On this point, from the far west, with unfavorable water conditions the general sentiment among boiler people in this territory is to the effect that the syphon diminishes firebox maintenance and benefits crown sheet and crown bolts. This is confirmed by the general boiler inspector.

Here is one from the far north. Such a marked improvement in firebox maintenance in engine equipped with syphons that authority is asked to equip every engine with syphons to operate trains 1 and 2. The improvement is shown mostly in the crown sheets. No button head crown bolts were used. Improvement is also shown in the side door and back tube sheets, practically no maintenance.

Again from the west. Just received report from a western road having nearly 100 syphon equipped locomotives. Great improvement in condition, of back flue sheets as compared with non-syphon locomotives. Back flue sheets soon became defective due to fractures and pitting of the top flange and other areas that they must be renewed after 15 months service. Syphon equipped locomotives, no fractures in the back sheets after two years service, apparently in as good condition as when installed.

Another in the southwest. Flue staybolts and side sheets of non-syphon locomotives renewed in about 18 months. On syphon locomotives running about 2½ years and still in excellent condition. A comparison after 14 months service showed

rigid staybolts on representative syphon equipped locomotives of 4 water space and 7 radials on the non-syphon 135 and 37.

I do not think it is necessary to read anything further. It is on account of this very real return in flue life and firebox maintenance that I have taken your time to read these over and show you what circulation will do. There have been about 2800 locomotives equipped on 101 roads, going to show that it is not limited in any way. This business could not have been secured unless we had obtained results.

PROF. LOUIS E. ENDSLEY: I would like to move that a rising vote of thanks be extended to Mr. Seley and to all the other gentlemen who have taken part in this discussion, some of whom have come long distances to assist in this meeting, which has developed into a very valuable discussion.

The motion was duly seconded and prevailed by unanimous rising vote.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

C. L. WELTY
Died July, 1925

C. M. HAWKINS
Died August, 1926

H. B. THURSTON
Died March 25, 1927

STATEMENT OF THE OWNERSHIP MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

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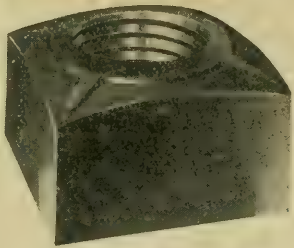

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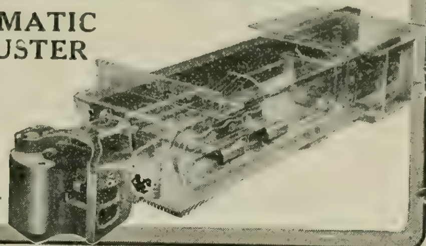

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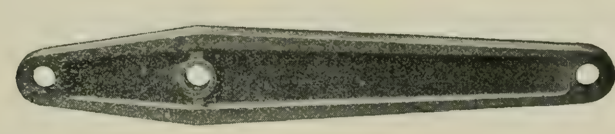

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H. H. MAXFIELD	November, 1919, to October, 1920
FRANK J. LANAHAN	November, 1920, to October, 1921
SAMUEL LYNN	November, 1921, to October, 1922
D. F. CRAWFORD	November, 1922, to October, 1923
GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING
MAY 26, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 7:00 o'clock p. m. (Eastern Standard Time), President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Allen, E. J.
Altsman, W. H.
Ambrose, W. F.
Anderson, A. E.
Babcock, F. H.
Bailey, Frank G.
Bald, E. J.
Balzer, C. E.
Brinkhoff, W. H.
Bull, R. S.
Candee, A. H.
Cannon, T. E.
Carlson, L. E.
Champion, James H.
Conway, J. D.
Cooper, F. E.
Cotter, George L.
Crawford, G. M.
Cromwell, H. T.
Cruikshank, J. C.
Cunningham, W. P.
Davis, Charles S.
Dempsey, P. W.
Diven, J. B.
Doran, F. E.
Eichhorn, T. F.
EnDean, J. F.
Endsley, Prof. Louis E.
Fenton, H. H.
Follett, W. F.
Fritz, A. A.
Geddes, D. Y.
Gilg, Henry F.
Godfrey, C. H.
Hackett, C. M.
Hale, Charles E.
Heckman, C. J.
Herald, M. A.
Hollingsworth, C. N.
Honsberger, G. W.
Householder, J. A.
Hunter, Bernard E.
Johnson, Nelson E.
Kaup, H. E.
Kelly, H. B.
King, J. W., Jr.
Klassen, Fred G.
Kroske, J. F.
Lanahan, J. S.
Lawson, A. F.
Leisenring, W. J.
Lewis, Walter M.
Lobez, P. L.
Loeffler, George O.
Lohr, A. W.
Lynn, Samuel
Maliphant, C. W.
Maloney, J. J.
Mitchell, W. S.
Moses, G. L.
Muir, R. Y.
Mundy, F. I.
Myers, W. H.
McCornish, W. C.
McGregor, D. C.
McKinzie, E. M.
McLaughlin, H. B.
Painter, C. L.
Painter, Joseph
Prouty, E.
Provost, S. W.
Raser, George B.
Rauschart, E. A.
Read, A. A.
Record, J. F.
Renshaw, W. B.
Reynolds, D. E.
Rowles, L. L.
Rushneck, G. L.
Sayre, F. N.

Schrader, A. P.
Sharp, H. W.
Shellenbarger, H. M.
Shelly, D. L.
Sheridan, T. F.
Simons, P.
Smith, Frank D.
Smith, H. K.
Spielmann, J. A.
Storer, N. W.
Stucki, A.
Sykes, A. H.
Van Blarcom, W. C.
Van Ryn, William
Warren, A. T.
Watts, Charles J.
Wikander, O. R.
Wildin, G. W.
Williams, A. G.
Woodward, Robert
Wright, O. L.
Wurts, T. C.

VISITORS

Adams, C. C.
Baker, J. B.
Barlow, Sam J.
Bell, John W.
Blackwell, W. B.
Blanton, H. J.
Boyden, J. A.
Brooks, Howard
Carthew, John W.
Clabaugh, C. C.
Clugston, W. L.
Cole, H. F.
Coleman, L. G.
Crawford, Edmund N.
Daryman, T. A.
Dietz, W. P.
Dodd, S. T.
Erickson, Clarence
Ferguson, Donald S.
Fruman, N. L.
Garrison, W. L.
Hastings, W. S.
Hatt, Harry
Henry, E. W.
Hershberger, David C.
Hibbard, W. J.
Horton, H. R.
Kirkpatrick, R. L.
Kline, I. N.
Lewis, S. B.
Millard, W. H.
McCarthy, J.
McHattie, William
Osgood, Norbert E.
Painter, J. B.
Partington, James
Provost, William J.
Puch, P. H.
Reed, L. J.
Roan, H. E.
Smith, Sion B.
Taylor, H. L.
Whittaker, C. C.
Wilson, J. R.
Wilson, W. O.
Womack, Charles F.
Woods, G. M.
Yetso, J. J.

PRESIDENT: The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they are to appear in printed form.

The Secretary read the following list of applications for membership:

Blackwell, W. B., Lub. Engineer, The Texas Company, 31 East Washington Street, Hagerstown, Md. Recommended by H. B. McLaughlin.

Blair, John R., Manager of Sales, Pittsburgh Steel Products Company, Union Trust Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Braden, Lou, District Sales Manager, Wyoming Shovel Works, First National Bank Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Coleman, L. G., Manager, Locomotive Department, Ingersoll-Rand Company, 11 Broadway, New York, N. Y. Recommended by G. W. Wildin.

Fallon, James J., Jr., Supt. Shipping, South Side Works, Jones & Laughlin Steel Company, 101 Poplar Street, Carrick, Pittsburgh, Pa. Recommended by Jas. R. Geddes.

Gordon, George L., Asst. General Manager of Sales, Lukens Steel Company, Coatesville, Pa. Recommended by J. D. Conway.

Howells, Wyman, District Sales Representative, Reading Iron Company, First National Bank Building, Pittsburgh, Pa. Recommended by J. D. Conway.

Kline, I. N., Foreman, Westinghouse Air Brake Company, 510 Grandview Avenue, East Pittsburgh, Pa. Recommended by G. W. Wildin.

Lally, C. V., General Manager of Sales, Pittsburgh Steel Products Company, 605 North Negley Avenue, Pittsburgh, Pa. Recommended by J. D. Conway.

Loeffler, George O., Sales Manager, King Pneumatic Tool Company, Bessemer Building, Pittsburgh, Pa. Recommended by J. D. Conway.

O'Donnell, F. A., Representative, Industrial Products Corporation, First National Bank Building, Pittsburgh, Pa. Recommended by W. R. Gummere.

Patton, William T., Head of Time Study Department, Westinghouse Air Brake Company, Wilmerding, Pa. Recommended by G. W. Wildin.

Swift, W. G., Asst. to President, Clark Car Company, Oliver Building, Pittsburgh, Pa. Recommended by Charles H. Clark.

Symons, F. E., President, The Ralston Steel Car Company, Columbus, Ohio. Recommended by J. D. Conway.

PRESIDENT: These applications will be referred to the Executive Committee in the usual course, and upon approval by them the gentlemen will become members without further action.

The Secretary has an announcement to make that will be of interest to the members of the Club.

SECRETARY: This Club has received signal honor from one of the greatest railroads in the United States. The Baltimore & Ohio Railroad Company has seen fit to reignize The Railway Club of Pittsburgh by presenting to it one of the commemorative medals issued by them upon the occasion of their recent one hundredth anniversary:

"1827————1927"

"The President and Directors of THE BALTIMORE AND OHIO RAILROAD take pleasure in presenting to THE RAILWAY CLUB OF PITTSBURGH the enclosed Centenary Medal issued in commemoration of the One Hundredth Anniversary of the Company."

In appreciation of this recognition of our Club I would move a vote of thanks to the President and Directors of the Baltimore & Ohio Railroad.

The motion was duly seconded and prevailed by unanimous vote.

Mr. J. A. Spielmann, Assistant to General Superintendent of the Baltimore & Ohio Railroad, described a new type of gas-electric passenger motor car which they are trying out and which will be in Pittsburgh in a few days and extended an invitation to the members of the Club to inspect the car.

PRESIDENT: If there is no further business to come before the Club, we will take up the paper of the evening. We have with us as our speaker this evening a gentleman who is a thorough railroad man, of many years' experience. He has just lately gone into the industrial field and is now manager of the Locomotive Department of the Ingersoll-Rand Company, who are making a specialty of the development and promotion of Diesel-Electric locomotives in conjunction and collaboration with the American Locomotive Company and the General Electric Company. I have pleasure in introducing to you Mr. L. G. Coleman, as the speaker of the evening, who will discuss Diesel Locomotives.

DIESEL LOCOMOTIVES

By MR. L. G. COLEMAN,

Manager, Locomotive Department, Ingersoll-Rand Company, New York, N. Y.

It is frequently asked why, with the great improvement in steam locomotives and the better results obtained from new operating methods, it is desirable to look for a different type of motive power.

At first blush this seems a reasonable question. I believe, however, an anlysis of steam locomtive operation will indicate the reason.

I do not intend to bore you with a lot of statistics, but I am going to quote a few approximate general figures based upon I. C. C. Annual Reports. They are conservative and can be checked by anyone.

The American Railroads in 1926 used approximately 150,000,000 tons of locomotive fuel. Of this amount probably less than 9,000,000 tons reached the drawbar to move traffic.

It required to handle this fuel the use of 80,000 cars which represent an investment of $170,000,000. The annual cost of maintenance of these cars was approximately $11,000,000. There were during the year approximately 110,000 trains moving over one engine division in the exclusive service of handling railroad fuel. 104,000 of these trains hauled fuel which did no work. This required at least one thousand locomotives.

There is an investment in coaling stations, cinder pits, water stations, etc., for the exclusive use of steam locomotives of about $200,000,000. The maintenance of these facilities costs approximately $16,000,000 a year.

In other words the investment, depreciation and maintenance charges for the cars and coal handling facilities required by steam locomotives amount to an annual charge of $64,000,000.

There is in addition considerable valuable terminal property and some main line track capacity taken up in handling this fuel. The cost of switching company fuel and its proportion of bad order cars is a very considerable item.

The tendency of steam locomotives is to larger units which require larger and heavier operating and maintenance facilities. It has so far been impossible to double head steam locomotives without doubling the engine crew as well. Hence the increased cost of the larger steam locomotive is only a part of the expense.

To sum up, not only is over ninety per cent of the fuel purchased lost, but also an indirect expense distributed to other accounts about as great. The most optimistic claims for overall thermal efficiency of steam locomotives look for an increase to 10% at most and this is problematical.

If a satisfactory internal combustion locomotive using oil for fuel can be developed for all classes of service, the overall thermal efficiency can be increased from the present five or six per cent of steam, to twenty-five per cent. In other words, instead of a little less than doubling the amount of work done by the fuel in the present locomotive an internal combustion locomotive can surely make it four times as great. A good illustration of this is the fact that as much traffic can be moved with one 10,000 gallon fuel tank of oil in an internal combustion engine as with twelve 50 ton cars of coal with a steam locomotive. Surely this is a goal worthy of serious and continuous consideration by both motive power manufacturers and and railroad officers.

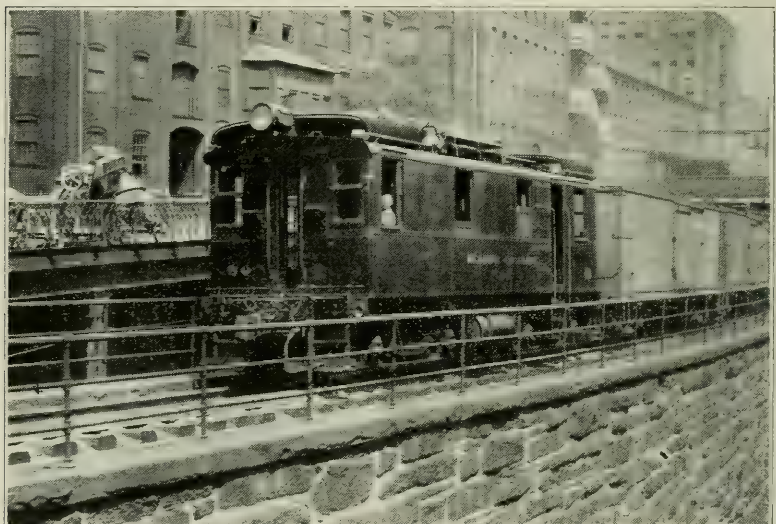
Not only will an internal combustion locomotive show an immediate saving in fuel burned, roughly in proportion to its thermal efficiency, or in other words reducing the cost of fuel per ton mile to about one quarter of what it is today but eventually saving also the $26,000,000 paid annually for locomotive water, and reduce the investment in cars for company fuel 90 per cent and will wipe out 95 per cent of the investment, depreciation and maintenance cost of coal chutes, cinder pits, water stations and turn tables, at the same time releasing much valuable terminal property, and at least 1,000 locomotives a day. The money this would save is apparent from the figures just quoted. Such locomotives lend themselves to gradual installation making possible proportionate accomplishment of such economies.

Oil electric locomotives will require much less roundhouse and shop capacity. It is apparent that as great as the direct saving in fuel would be the indirect savings by the substitution of such motive power, particularly the saving in future investments of this nature would mount up to a large figure.

There seem to be reasons enough to look for something better than steam—what are the chances of finding it? Further operating economies must be in the more intensive use of existing equipment rather than the purchase of more units. More ton miles per locomotive per day is and will continue the objective. The two principal ways to accomplish this are to

make faster time between terminals and, more important still, shorter and fewer delays in terminals.

I am sure all railroad men will agree that much prompter movement is possible when motive power can be kept moving in a steady stream instead of in surges as at present under most steam operation.



60-ton Oil Electric Locomotive owned and operated by the Reading R. R. at Philadelphia. Locomotive is moving cars up an incline that raises thirty feet in a distance less than one city block.

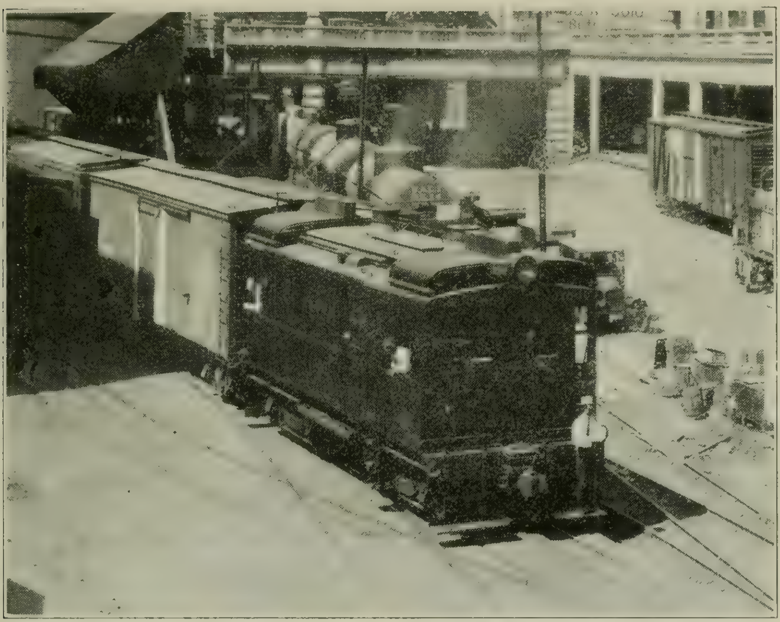
One of the inherent drawbacks to steam locomotive operation has been the impossibility of prophesying 12 or 24 hours in advance what will be the average turning time of steam locomotives, whereas it could be very closely anticipated with internal combustion operation, thus minimizing congestion in through terminals and particularly at junction points.

With this situation in mind the only question would seem to be the possibility of developing the new type locomotive. Assuming mechanical practicability the principal argument against internal combustion locomotives is generally the question of first cost.

Many of us can remember when we were young in the "Gay Nineties" that a good horse and buggy could be bought for considerably less than $1,000. There was then about one horse and buggy to every 1,000 people. The average automobile costs over $1,000 and there is now an automobile to

every five people so if a piece of machinery will deliver the goods the first cost is not essential.

The interesting question seems to be the possibility of developing the new type locomotive and I propose to tell you a little about what has been done and what we believe can be done.



The single unit Oil Electric Locomotive on the C. & N. W. R. lines working east of Michigan Avenue and looking toward the city, Chicago.

As I am with a company that is building these locomotives I must, of necessity, largely talk of what we have done and propose to do as it is the only information I am sure of.

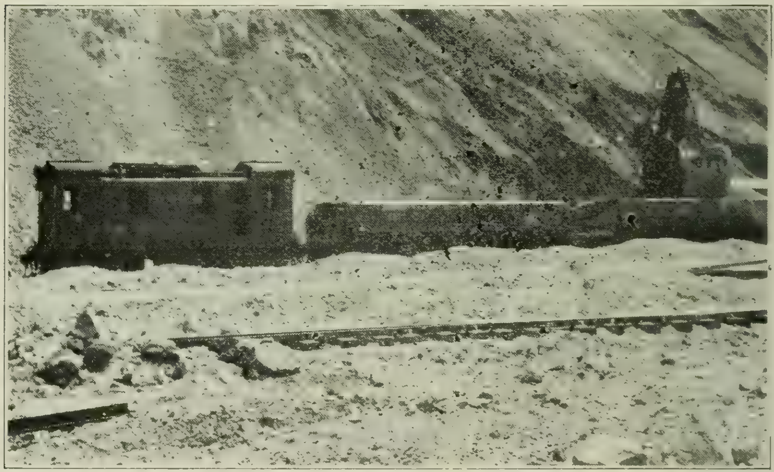
While we were pioneers in the field, and, I believe are the only manufacturers who have such locomotives in actual service in this country at the present moment, I do not wish to insinuate that we are the only ones who can or will develop such power and I, therefore, trust that you will bear with me if I dwell upon our own product.

When first considering the adaption of Diesel engines to rail service, the serious problem seemed to be that of reduction in weight without decreasing the sturdiness of the engine. The second problem, that is not of minor importance, was to develop an engine that could constantly vary its speed without unduly

increasing its fuel consumption or impairing its mechanical durability.

Those who first figured the requirements, who by the way were not internal combustion engine manufacturers, came to the conclusion that a maximum limit for efficient operation was about 60 pounds per horsepower.

The first developments were made with comparatively small engines for two reasons. First, it was easier to develop such sizes and secondly it was realized that switching service could be performed with Diesel locomotives of lower rated horsepower than steam locomotives. The reason for this is, of course, that the full horsepower of internal combustion engines is available at all locomotive speeds whereas the horsepower of a reciprocating engine is dependent upon the speed of the loco-



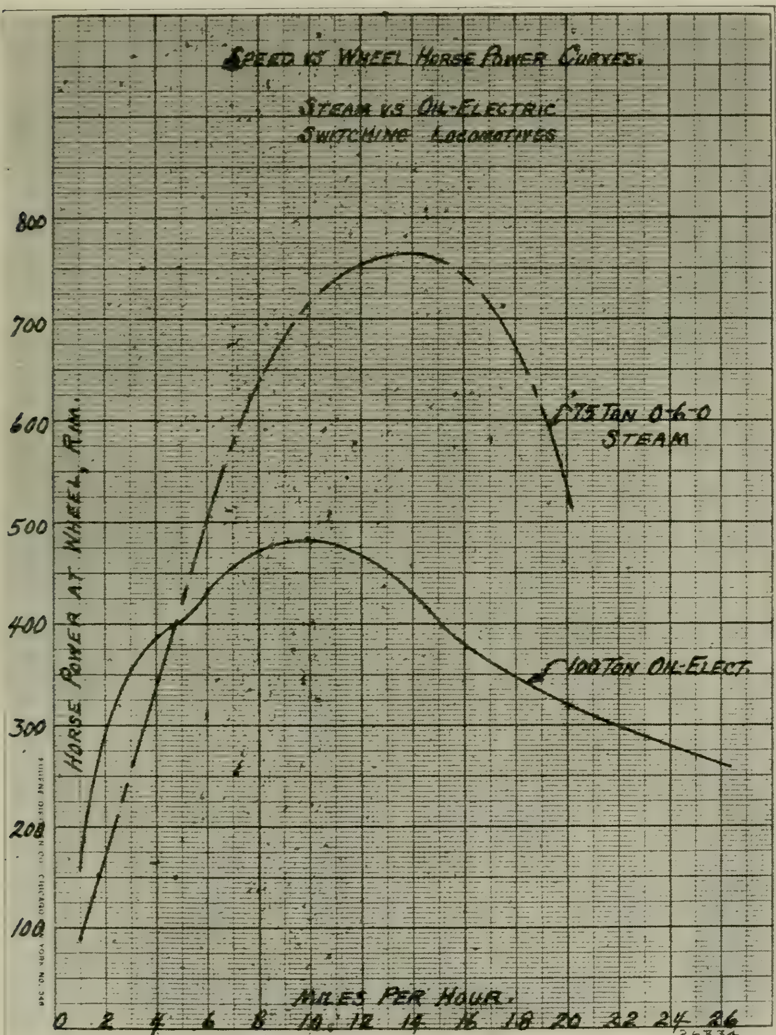
60-ton Oil Electric Locomotive in use by Utah Copper Company, Bingham, Utah.

motive which controls the piston speed. Further, electric transmission gives a better use of the horsepower at low speeds than the equivalent horsepower from a reciprocating engine.

Even with a very small wheel, it is difficult to design a steam locomotive with economical piston speeds that are available much lower than 10 miles per hour.

A large part of the switching is done at speeds considerably less than 10 miles per hour and, therefore, in order to get sufficient tractive effort at starting and at speeds up to five or six miles per hour it is necessary to use a steam locomotive of much higher rated horsepower than that actually delivered.

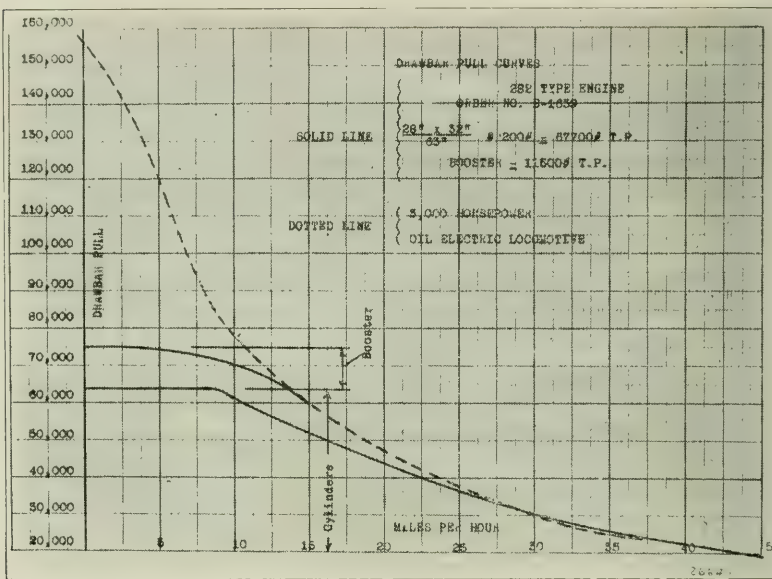
In passing I wish to point out that with electric transmission there will be very much less damage to cars in switching than with reciprocating engines. There will be a large indirect saving in the number of bad order cars including the cost per diam while being repaired and the cost of switching to and



from the rip track. This saving, of course, can only be estimated but the total will be large.

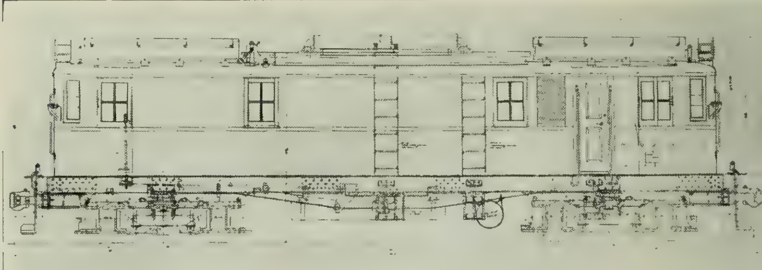
In road service where speeds of 20 miles per hour and higher are used, it is, of course, necessary to have as much horsepower in an internal combustion locomotive as in a steam

locomotive. One horsepower of oil engine can't do any more work on the wheel than one horsepower of steam engine, the point is to get it there.



Draw bar pull curves comparing steam locomotive and the Oil Electric Locomotive.

It should be remembered that in an oil electric locomotive the power of the prime mover has no fixed relation to the speed of the locomotive. It is merely a question of gearing between



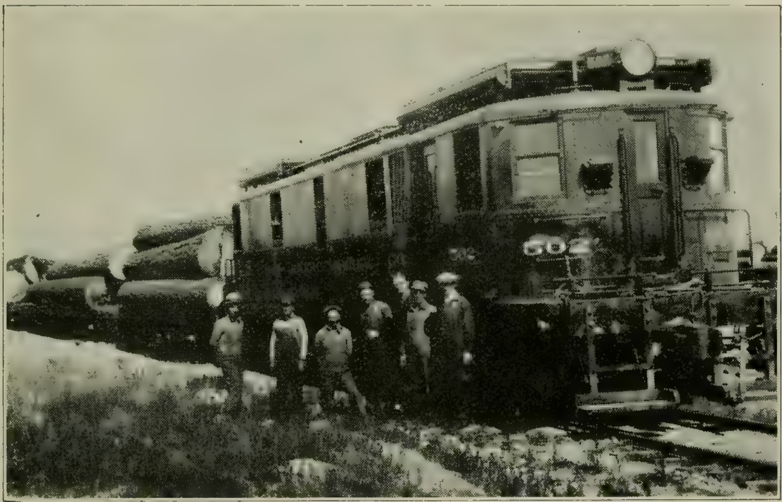
25137. OUTLINE OF 100 TON OIL ELECTRIC LOCOMOTIVE
1 CLASS B-B 200 200

the electric motor and the axle so in switching locomotives where high tractive effort at low speeds is desired a low gear

ratio is used, whereas the same locomotive can be turned into road service by changing the gear ratio, somewhat reducing the tractive effort at low speeds. This has not been generally understood.

It is possible to build an oil electric road locomotive that can take a train for 1,000 miles without the necessity for taking on supplies of any nature. There is no mechanical reason why such a locomotive could not take a train across the continent by taking oil at two or three points. It would take a train to Chicago from New York and bring one back an hour after it arrived.

The Ingersoll-Rand Company, in conjunction with the General Electric Company and American Locomotive Company,



100 ton Oil Electric Locomotive built for the Red River Lumber Company of Westwood, Calif.

have built and have in service switching locomotives of 300 and 600 horsepower. There are 12 300-horsepower locomotives in service today, the oldest one 18 months and the newest one month. They have operated for an average fuel and lubricating cost of 20 cents per hour. There are three 600-horsepower locomotives that have been in service, the longest one 16 and the newest one five months. They have operated for an average cost for fuel and lubrication of 40 cents per hour.

We have built a 750-horsepower oil engine, the first of which is being assembled in a locomotive at Schenectady for an Eastern railroad and we are designing a 1,500-horsepower locomo-

tive, made up of two 750-horsepower engine generator sets assembled very much in the same manner as in the 600. It is, of course, possible to couple two or three of any of these locomotives together and have them operated by one engine crew. I have put on the slide the tractive effort of the 750, 1,500 and 3,000 horsepower oil electrics and compared it with the tractive effort curves of some standard steam locomotives.

100 ton Oil Electric Locomotive operating on the Great Northern Railroad at Minneapolis.

I will now show you some pictures of these locomotives under varius operating conditions.

A number of pictures were then illustrated on the screen.

PRESIDENT: As I said in the opening, this machine is the result of collaboration and co-operation of the General Electric, American Locomotive and Ingersoll-Rand Companies. We have with us representatives from each of those companies. I am going to ask Mr. Dodd, engineer of the General Electric Company, to give us a further discussion of the subject.

MR. S. T. DODD: Mr. Coleman has mentioned the electric transmission on the oil-electric locomotives. It may be of interest to point out some of the problems which have to be met in designing the electric transmission for such locomotives.

The internal combustion engine at its normal output is essentially a constant speed, constant torque machine. The requirements of traction, however, demand a wide variation in

speed and torque. At starting and on heavy grades, a high tractive effort is required, while at full speed a moderate tractive effort is required, but developed at a high speed. Under either conditions it is desirable to exert the full horsepower of the engine. Some type of transmission is therefore required which can vary the torque and speed developed by the engine so as to meet the varying requirements of the service.

Electric transmission lends itself very easily to meeting this transmission requirement. Various other methods of transmission have been applied and more or less developed. Mechanical, hydraulic and pneumatic transmission have all been used to some extent, but as in many other fields electric transmission has demonstrated so many advantages that it has been generally accepted as the transmission on all heavy oil-engine drives.

The clearest exposition of this feature of electric transmission can be obtained by studying the transmission characteristics in the form of curves. Referring to Curve No. 1 of Figure No. 1, whether the output of the electric equipment is—say 1,000 volts and 200 amperes—or is 500 volts and 400 amperes, the engine output is the same, but the tractive effort developed by the motors on the driving axles is two to three times as great under he latter condition as under the former condition. Curve No. 1 represents, therefore, a constant load on the engine. Any reasonable generator which we can design for such an engine will be limited to some maximum voltage and some maximum current. We can, however, design a generator with a range of current and voltage sufficiently wide for all reasonable purposes.

Curve No. 2 of Figure 1 shows the characteristic of such a generator with manual control. The generator is designed for a constant voltage. If maintaining this voltage constant, we gradually increase the ampere load, we come to a point where the load characteristic of the generator crosses the engine curve; that is, the kw. output of the generator is equivalent to the horsepower developed by the engine. It is, of course, impossible to go beyond this point without overloading the engine. Such overloading would slow down the engine and cut down its available horsepower. In order to avoid this overload, it is necessary to reduce the voltage of the generator with an increase in current in order to keep its characteristic inside the engine curve. This result can be obtained with a generator of normally constant voltage and with the strength of the field adjustable by

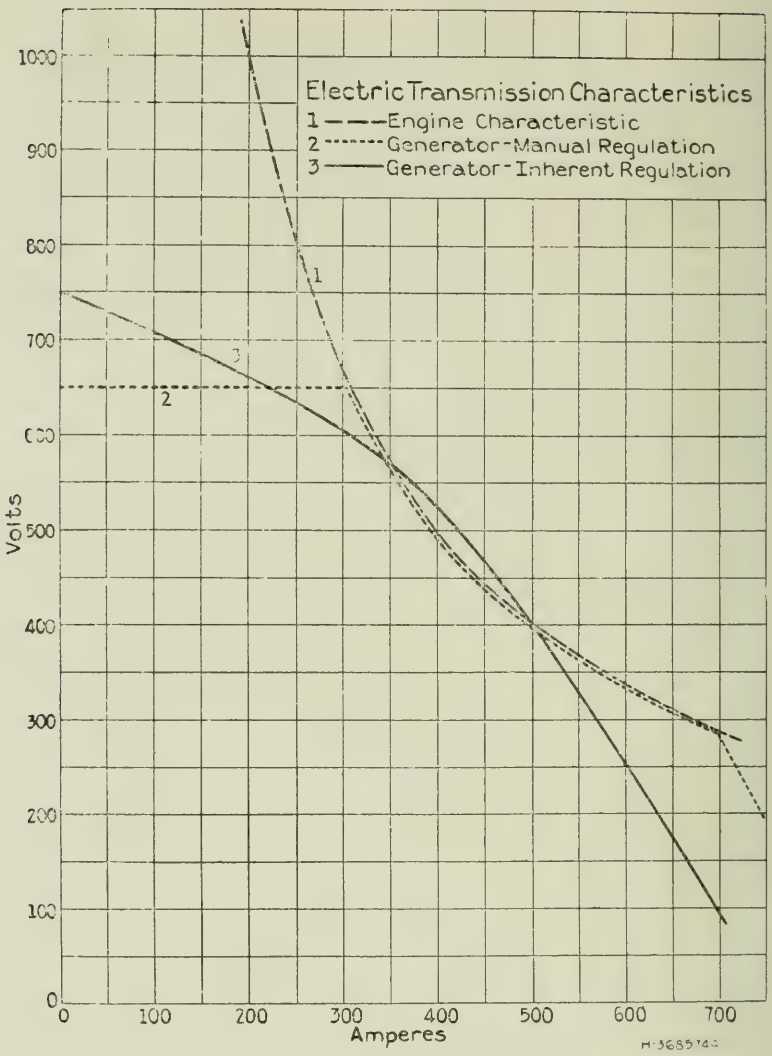


Fig. 1—Transmission Characteristics.

hand. The scheme of connections for each control are shown in Figure No. 2.

The gas-electric cars built by the General Electric Company in 1910 to 1915 were equipped with hand control of the generator field, such as I have described. The field of the generator was adjusted by the operator so as to maintain full load on the engine and still not overload it. About 90 such equipments, both locomotives and cars, were put in service at that time and approximately half of them are still in active operation.

A more convenient method of control is to design an electric equipment in which the same results will be obtained by inherent regulation of the generator. The plan which has been used satisfactorily in our recent equipments is to use a generator with an automatically drooping characteristic obtained by putting a differential series field either on the generator or on the exciter. Curve No. 3 of Figure No. 1 shows the characteristic of such a generator and Figure No. 3 shows the corresponding scheme of connections. Theoretically such an equipment does not load the engine through as great a range as can

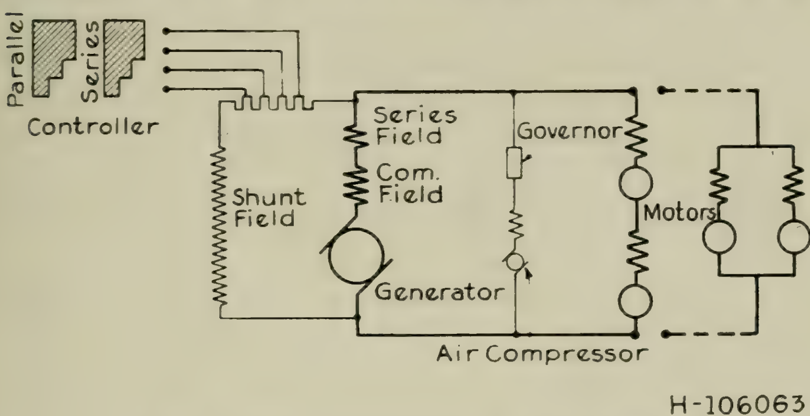


Fig. 2—Scheme of Connection for Hand Control.

be obtained by manual control, but practically we believe that it is more effective. An operator cannot be depended upon to continuously keep his generator field adjusted by hand so as to load his engine up to its full capacity. Inherent regulation, while it does not give exactly the required curve, is so close to it that the average results are better than are ordinarily obtained by manual regulation.

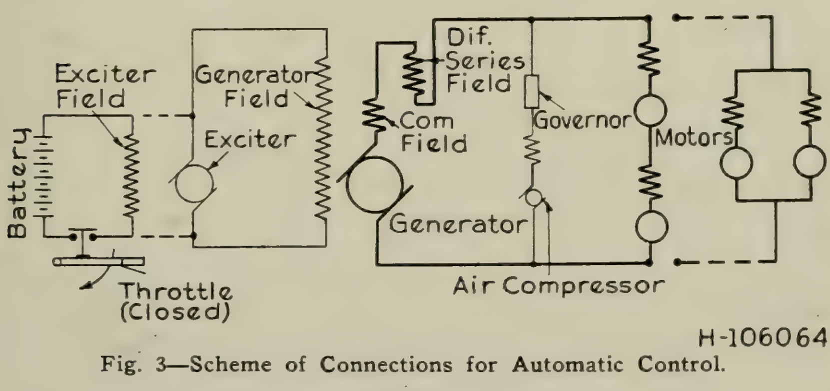


Fig. 3—Scheme of Connections for Automatic Control.

Other plans of electric control may be devised, but in general, the requirement will always be to design an electric equipment which, through a reasonable range of volts and amperes, will keep the engine fully loaded. In other words, so that the engine will exert its full output with a wide variation of tractive effort and speed.

By making use of various combinations of the motors in series and parallel, it is possible to obtain a tractive effort curve which runs parallel to the theoretical curve through a wide range, although the generator and engine curve may correspond only within very narrow limits.

If we compare the results obtained by electric transmission with those which can be obtained by mechanical transmission, we find that claims for advantages are made and can be substantiated by both parties. Mechanical transmission with direct gearing from the engine to the driving wheels is probably the most efficient at certain speeds. However, it involves changes in gear ratio to obtain the widely varying torque and speed which are required. These changes in gearing involve slowing down the engine and thereby reducing its power in going from one step to the next. This is followed by a period of speeding the engine and its load up to the maximum allowable engine speed when another gear shift again overloads and slows down the engine. The electrical transmission is equivalent to an infinite number of gear changes so that the resultant acceleration curve is a smooth curve rather than a step by step curve. Mechanical gearing is probably more efficient than the electric gearing at normal speeds, but there are only a limited number of such speeds in the tractive effort range and the electric transmission in spite of being less efficient at normal speed and load shows better and more efficient results through the whole range of operation.

PRESIDENT: I will next call on Mr. James Partington, manager of the engineering department of the American Locomotive Company.

MR. JAMES PARTINGTON: Mr. President and Gentlemen of the Railway Club of Pittsburgh: Mr. Coleman has certainly presented a very attractive picture of the oil-electric locomotive, and a rather alarming picture of the steam locomotive. When I received an invitation to come here I supposed that what I had to say would be very easily said, that I would only be expected to speak a few words regarding the mechanical con-

struction of the oil-electric locomotive. Since coming here I have had some intimations that I am, in a way, regarded as the "White Hope" of the steam locomotive. When I was located in Pittsburgh some 20 years ago I had the pleasure of attending many meetings of this club, and my recollection is that this club is particularly noted for its friendship and fellowship, and that the friendship feature is often emphasized by having some speakers comment on the paper of the evening by making statements that are somewhat critical. You will readily see that this places me in a rather awkward position. But to get to some sort of a basis of understanding I would like to tell you a little story.

Quite a celebrated New Englander, while speaking a few months ago before the New England Society, said that in going around the country he found a general impression that the smart men of New England left that part of the country and made thier reputations and their fortunes in other sections of the United States. He said that was not correct, that the smart men of New England were the men who stayed there, because it took a smart man to earn a living in New England. He went on to illustrate this by saying that a fellow townsman of his in Maine, who stayed in New England, had several vocations. One of his jobs was trading horses when opportunity offered. He sold a good looking horse to a Boston doctor for eight hundred dollars. When the doctor started to drive the horse he found that it was a biter, a kicker and generally vicious animal. So at the first opportunity he told these things to the man back in Maine. The horse dealer said nothing and seemed to take it rather as a matter of course, and the doctor got a little excited and said, "Did you know about that?" "Yes," he said, "I knew about that." "Why didn't you tell me?" "Well," he said, "the man who sold that horse to me didn't say anything about it, and I thought it was a secret."

Now, to have this meeting on the basis of good fellowship, there ought to be no secrets between us. I could talk more about the steam locomotive, probably, than about the oil-electric, but I will start in at once by admitting that the steam locomotive burns coal, probably more than it ought to burn. But whether it does or does not, that may be to some extent a secret, and I will not try to answer that part of the question. I will admit that the steam locomotive burns coal. We have a great many locomotives running around the country burning coal, not entirely for the reason that coal has to be burned, but

I strongly suspect because the steam locomotive is the most flexible machine with which our railroads have ever been equipped. In connection with the possibilities of the oil-electric locomotive it may be well to remember that in the early days of the electric locomotive, the steam locomotive was doomed to an early demise by many engineers, not by all, and all steam locomotives were to be replaced in a short time by electrics. At that time the Pennsylvania Railroad did not have a pacific type locomotive on its whole system. We all know the steam locomotive has stayed in the game and has been greatly enlarged and improved and has rendered much more effective service as the years went by. Some of our electric engineering friends tell us that the credit is due to them, that without the advent of the electric locomotive the steam locomotive engineers would have laid back on their laurels and not made any further improvements. I am not in any sense ready to admit that. I think the development of the steam locomotive in the last 20 years has gone largely hand in hand with the development of the electric locomotive and the development of all sorts of mechanical contrivances, for we are living in a mechanical age. The history of the electric locomotive is that it has been installed in different parts of the country and it has been gradually improved and made more and more powerful and more and more efficient, and it has found its place on our railroads and that place is quite an important one today. My feeling in regard to the oil-electric locomotive is that it, likewise, has a place and it will find its place. It is starting out at a time in locomotive development that it is somewhat handicapped. It has a long distance to make up, in that the electric locomotive and the steam locomotive of today are developed and are being built to about their maximum horsepower, as governed by conditions of tracks and bridges on our railroads. The oil-electric locomotive is, of necessity, starting out with smaller units, but in these, sizes have already developed very remarkably, and I think it has been demonstrated that it can do work suited to its capacity at a large saving in fuel cost, and of course it has many of the advantages of the electric locomotive. Coupled with these advantages it has the added recommendation of unit operation and unit installation the same as the steam locomotive. That is, the oil-electric locomotive does not require any other facilities, such as power plants, etc., and some steam locomotive facilities can be subtracted.

In regard to the mechanical construction of the oil-electric

locomotive, I do not think there is very much to say that is of paricular interest. I think there is very little that you do not already know. When the oil-electric locomotive is of truck type, the weight is less per horsepower than when the steam locomotive type with drivers and guiding trucks is used. The motor trucks used are identical with some of the electric locomotives in construction of the truck, type of motor and method of installation. The cab underframe is not much more than a tender frame. It has to be substantially built and arranged for the installation of the oil engine and the generator. The oil engines are designed and placed to keep within the limits of locomotive clearances, and for that reason the units as single units are, at least thus far, of rather moderate size, 750 horsepower being the largest single unit mentioned tonight. To keep within the usual locomotive clearances and build more powerful units will mean a higher speed oil engine, which might not be desirable, or some change in the type of the oil engine to get greater horsepower. When locomotives must be of the locomotive frame type with driving wheels and truck wheels, a greater weight per horsepower is involved. Two of this type of oil-electric locomotives are being built now for road service.

I will close my brief remarks with the statement that the oil-electric locomotive certainly has a future and I think we will find it will take its place side by side with the steam locomotive and the electric locomotive in railroad service.

PRESIDENT: We have now heard from the real lights that are co-operating with each other in preparing this Diesel locomotive. I am going to cross over now to another camp. I am going over to the Westinghouse Electric & Manufacturing Company. We have with us tonight Mr. N. W. Storer, consulting railway engineer of the Westinghouse Electric & Manufacturing Company, who has consented to discuss the subject.

MR. N. W. STORER: Mr. President, fellow members and guests: I have been very much interested in both the paper of the evening and the discussions. Mr. Coleman I have heard before and enjoyed very much every word he said. I am not at all surprised to see him here tonight passing compliments on the steam locomotive. I have heard him do that before. But I am very much surprised to find the "White Hope" of the steam locomotive swallowing all the statements Mr. Coleman made. I do not know whether it is up to me as an electrical man to defend the steam locomotive or not. But I want a little more

light on this statement Mr. Coleman made that 10,000 gallons of oil is able to do the same work as 600 tons of coal. I do not get that at all. He just got through making the statement that the oil-electric locomotive has four times the thermal efficiency of the steam locomotive, and then he goes on to say that 12 times the thermal units in coal are required to do the same work as in oil. I think I have quoted him correctly. If my slide rule is working correctly, 600 tons of coal have about 12 times the thermal units that 10,000 gallons of oil have. I do not know just how he explains that. He goes on further to say that the fuel cost for the steam locomotive is four times as great as that for the oil-electric. I presume because it takes four times as much coal. It may be because it takes 12 times as much, but he did not say that in the first place. I think one of his boys must have made those figures for him.

Now, after all, what he said has a great deal of truth in it. It is very true for the most part, and I do not want to defend the steam locomotive—when there are a good many men here who are much better qualified than I am to do so. In fact, my natural leaning is in the other direction. But the steam locomotive is here and here to stay for several years yet, and we have got to look at it. Something is to be conceded to the steam locomotive.

Mr. Dodd gave a very clear picture of some of the problems that are presented to the electric engineer in designing equipment for the oil-electric locomotive. The several schemes which he outlined are in general use, and there are others which were not shown. The main thing, as he pointed out, is to be able to utilize the power of the engine at any speed and tractive effort at which it is desired, up to the limit of the capacity of the engine. The control of the generator voltage for that purpose should be just as nearly automatic as possible, and we have worked out several schemes along that same line, some of which will be explained at a later date when we can have a little more time for it. But that is the very essential feature. The equipment must be designed for the engine to get the most out of it. The engine is the expensive part of the equipment and we have to subordinate everything to that.

Unquestionably electric transmission is far superior to any other transmission that has been suggested for the oil-electric. The curve, as Mr. Dodd pointed out, is very similar to one I drew myself, which corresponds to the best information which could be obtained on the oil locomotive with mechanical drive.

indicating that a locomotive with mechanical drive will have to have an engine of 10 per cent to 20 per cent greater capacity to do the work that can be done with an oil-electric, because of the fact that you can get the full output of the engine with the mechanical drive at only the maximum speed and maximum tractive effort for each particular gear ratio. That means that where something less than maximum tractive effort is required to pull the train and yet not far enough down to take the next gear, the engine is working at a low speed and consequently not developing its power. I can not see any hope for the mechanical drive as it is worked out at the present time. The engine is too expensive per horsepower and the fact that you have to have a larger engine for a given service, offsets any possible increase in efficiency, but it is not a question of efficiency. There may be a little in favor of the efficiency of the mechanical drive, but it certainly is not sufficient to overcome the disadvantage of not being able to utilize the full power of the engine when you want it. The electric drive will give you a powerful, smooth torque, as Mr. Dodd showed, and right from maximum tractive effort at lowest speed to lowest tractive effort at maximum speed, covering a range of from six to sixty miles with the same horsepower in the engine at all times. That is quite a feat. You do have a very efficient power in the transmission system though you do not have quite the horsepower at the rail with the maximum tractive effort. But you get maximum tractive effort and it is all the wheels will hold on the rail.

There are other things in the equipment of the locomotive which I want to mention. One is the necessity for proper co-ordination of the auxiliaries of the equipment with the main power plant. It is very desirable, in fact it is necessary today, to get the most efficient performance of the equipment as a whole. The air compressor has to be run, and it should be able to be run at full speed at all times soas to have all the air that is required for braking purposes. One of the greatest difficulties and one of the criticisms that has been made a good many times of the gas-electric is that there is not sufficient compressor capacity. The main difficulty is that the compressor is driven by a motor from the main generator. The main generator is running at its full voltage only a small part of the time. The consequence is that the compressor is run at a very slow speed a part of the time. When the engine is idling it must be speeded up to get a voltage in your generator to run the air compressor. We avoid that by having equipment which will

permit the compressor to be run at its full speed any time that it is required, and we are able to do that by simply combining a small storage battery with the auxiliary generator when that is being run at full speed or the main generator run at slow speed. The main generator will carry the compressor at slow speeds very well. That is just one of the things that has been done to work some of the insects out of the oil-electric and gas-electric equipment.

MR. COLEMAN: I had those figures worked out with the old-fashioned pencil and a piece of paper. I think Mr. Storer gave one of the best illustrations of the fact that the slide rule is sometimes a guessing instrument. If he had used pencil and paper he would not have criticized. Mr. Storer said he had used pencil. You remember you said "if your slide rule was correct."

It is rather difficult to go into details but I will point it out. Six hundred tons of coal is 1,200,000 pounds, at 12,500 B. T. U. —10,000 gallons of oil is 80,000 pounds at 18,500 B. T. U. I used the total amount of coal the locomotives burn, including lighting fires, standbys and all that, that is the total amount of coal that the engine uses divided by the ton miles moved and taking the amount of oil necessary to move the same ton miles at 18,500 B. T. U. and 26 per cent efficiency. If you take just the amount of coal burned while the engine is on the road, that is not correct. But the average amount of coal burned by the engine while in service is larger. Take the total coal used and divide it by the ton miles and it is really 7 to 1, but we take 5 to 1 so as to be on the safe side.

As far as the air capacity is concerned, that has been entirely corrected. The first locomotives built we did not have full air capacity at idling but the last ones give us 100 per cent air at all times. There are two or three different ways to do it. We have not decided which is the best yet, but we are not getting 100 per cent air under all conditions.

MR. STORER: I notice you said the American locomotive takes this amount of coal. What does the Baldwin take?

MR. COLEMAN: I should have said the Class 1 railroads in the United States for the year 1925.

MR. STORER: I did not use my slide rule on this, at least if I did I checked it with a pencil and paper. Here are my figures. Seventy-five thousand pounds of oil, 18,000 B. T. U. is

1,350,000,000 B. T. U. for the oil. Twelve cars of 50 tons is 600 tons of coal. I got the same figure you did for the pounds and I took 14,000 B. T. U., which I will admit is high. The ratio between the B. T. U.'s of the two is 12.45.

MR. COLEMAN: That is quite right if it all were used on the road. My statement was not based on the total B. T. U. but on how much of that was used to move the freight.

MR. STORER: One-third of the coal gets to the steam engine then. Twelve and one-half times the B. T. U., and according to your own statement, it is 4.7 for B. T. U. and you have got something over 12 to 1 there, so that——

MR. COLEMAN: You figure it the other way. The average thermal efficiency of all the locomotives in service is not over 3½. Five per cent is too high. With all the locomotives in service they are not getting 3½ per cent. You will find if you take the coal as actually consumed and the work actually done, and the work that we have actually done, that is exactly the ratio you will get. It is a little more favorable to oil electric than I stated. The test plants experiments will show 5 per cent and even 6½ per cent, but an engine on the road, in average condition will get about 3 per cent.

PRESIDENT: It seems to me it is up to the Chairman to appoint an Arbitration Committee to reconcile the calculations of the combatants. I was thinking of calling on Professor Endsley to harmonize the divergent views.

PROFESSOR LOUIS E. ENDSLEY. This is very interesting to me, having been so very close to the locomotive at one time. It is true, gentlemen, that 3½ and 4 per cent would be the thermal efficiency for the average locomotive in the United States today on the road.

The size of the oil-electric locomotive needs to be increased to equal our present modern steam locomotives. I have a large place in my heart for the steam locomotive. It is not the most efficient power plant. Some of the modern steam locomotives are giving 5½ per cent, but those are engines that are not the average locomotive today. They are engines under 5 years old. That is very high efficiency for a power plant that allows the steam to leave at a temperature of 500 and 600 degrees under a pressure of from 4 to 8 pounds, because half the power is left in the steam at that pressure. That is lost by steam locomotives. But the steam locomotive is still working.

The electric locomotive is a very efficient locomotive in itself because it can get the maximum out of the coal in a steam generating plant at the power station. But when we think that the electric locomotive and its power plant has not yet equaled 16 per cent and the steam locomotive that turns half of it away equals 5½ per cent and also hauls its boiler around, and all the auxiliaries must be small and of lower efficiency than is in the stationary power plant, it speaks high for what we have done with the steam locomotive.

I was very much interested in this paper. It is a very far step in the saving of fuel and I imagine that if coal were sold at $20 or $25 a ton, as it is now in Switzerland, we would think a lot more of a power plant that would save three-quarters the coal.

I can see Mr. Coleman's side of it. It takes power to haul this coal from the mine to the locomotive, and that is a saving when you only haul a quarter as much. That is the gain the oil-electric shows and it is quite a saving. The number of cars released to revenue traffic will be material and the yard facilities will be increased, too. But it is not a thing that will come quickly. Nothing good in this development has come quickly. I was coming out of the City of Chicago in 1910. At that time there was a great agitation for the electrification of the railroads of Chicago. They appointed a commission to see how much dirt the city of Chicago was receiving from the locomotives. Professor W. F. M. Goss had charge of that work. A man in the car, evidently a man of some importance, said: "Within two years the whole city of Chicago will be electrified." My answer was: "If it is done in 15 years it will be quick." We have just now the first electrification running in the city of Chicago. But that does not mean that it will not come. Something is going to take the place in our congested points of the steam locomotive. In the districts of concentrated inhabitants, where the dirt is a detriment to the life of the people, it is bound to come. Mr. Coleman said tonight to me that we who are living today cannot say that anything cannot be done. Twenty years ago the airplane had not flown from New York to France, across the ocean, and nobody would have thought it possible. But it has been done. This power problem for the railroad is bound to be solved and there is a place for the steam locomotive yet, there is a place for the electric locomotive, also a place for the Diesel electric. The thing that is coming is power for less money. It is a feature of dollars, I feel.

PRESIDENT: Now that is disposed of. I am going to ask all of you to get your work in on Mr. Coleman. He enjoys a scrap. Get at him and ask him questions. He will answer them—in some way or another.

MR. STORER: If nobody else wants to ask questions I have something I will give Mr. Coleman a chance to think over. That is the question of the cost of fuel per B. T. U. of coal and oil. What is the value of the coal that is equivalent to the present price of oil? I will give him a chance to think about that while I tell you briefly something about the oil-electric equipment, rail cars, which are at present in operation on the Canadian National Railroad.

I know that is a government-owned railroad, but they started out as pioneers in the use of the Diesel engine for rail cars. They did not experiment at all with one equipment, they bought nine and scattered them all over their big system. Last year those nine cars made over 450,000 miles. That is more than 50,000 per car. One of them ran over 71,000 miles. It just shows what the equipment is capable of, applying to rail cars. Mr. Coleman has outlined the work for switching engines, which is certainly a fruitful field for the oil-electric locomotive. And the Canadian National Railroad has pointed the way for the economical operation of branch lines with the Diesel engine.

These engines, in spite of the fact that there were nine of them built and put in service at practically the same time, have shown a great saving and interest on the investment, including all the changes which had to be made in the engines, including all development changes in the cars, everything included, they still show a great saving. And they show so much of a saving over the cost of the steam locomotive that was used on these lines that I am ashamed to tell you how much it was. You will find it in one of the engineering papers at a very early date. These oil engines are very light, they are the Beardmore aircraft type of engines, and including the whole power plant—engine, generator, bed plate and all combined, it is a very light equipment compared with any other on the market at this time. And it is so light that it is quite satisfactory for rail car work. I am pretty familiar with this engine now, its performance rather than the engine itself, because the company that I represent has secured the manufacturing rights for that engine in this country and is prepared to build them. They are building engines of various sizes.

PRESIDENT: If there are no further questions, I will give Mr. Coleman an opportunity to close this discussion. Mr. Coleman, here is your time to get back at these fellows, as I will not give them a chance to come back at you.

MR. COLEMAN: There is no fun in it unless they can answer. I do not quite understand Mr. Storer's question. It is rather difficult to answer. Our locomotives are using oil all the way from 2¾ cents a gallon to 12 cents 18,500 B. T. U.'s. It depends on the location of the locomotive, the character of the road, the oil and coal they are using. The latter ran all the way from $2.25 to $6.00 on the engine, and all the way from 11,750 B. T. U. on one railroad to 14,500 on another.

As to the cost of the oil, the Great Northern is paying 2¾ cents a gallon, some others 4 and 5½ and one road 7½ cents a gallon, but the average is about 6½ cents. Most could get it for 5 cents or less if they used enough to buy it in tank car lots.

There is one thing I wish to say. I do not want you to get the impression, as you might gather from some things Professor Endsley and Mr. Storer may have said—we are not good friends. I think we are very much alike at bottom, but I am pushing one type and he is pushing both—as I said when I started out, I do not expect that we are going to put all the steam locomotives out of business tomorrow. I am not antagonistic to the steam locomotive. I feel personally very strongly that the American railroads are very conservative. Having been a railroad man for 25 years I understand it. They are busy moving traffic and subject to criticism from all quarters all the time. They are doing pretty well with steam locomotives and why not go ahead with them? The American Locomotive Company and the Baldwin Locomotive Company and the Westinghouse, I believe, are not antagonistic to the oil-electric locomotive. Unless it is economically sound it will not get anywhere and if it is economically sound they will be building them as fast as they are building the steam and electric locomotives today. I do not feel very strongly that any machine that is as inefficient, and must in the nature of the service and conditions remain as inefficient, as the steam locomotive, has no business to live any longer than is necessary to find a more efficient substitute. The railroads, as far as production of power is concerned, are 25 years behind stationary and marine practice. And they evidently will have to improve this situation. A lesson must be taken from the automobile manufacturers and reduce cost by

building a more efficient and cheaper machine. I do not believe the steam locomotive can be made enough more efficient and cheaper; it is purely a question of economics. The steam locomotive will, in the long run, give way; it is behind the times, but it will not disappear for many years. It will disappear gradually, and in time I think there will be something very much better than the present electric locomotive or oil-electric locomotive.

PRESIDENT: Is there anything further?

PROF. ENDSLEY: I wish to move that a vote of thanks of this Club be extended to Mr. Coleman for coming here and giving us this very interesting paper on the development of Diesel engines; also to the other three gentlemen who assisted him in giving this Club entertainment and information.

The motion was duly seconded and prevailed by unanimous rising vote. There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

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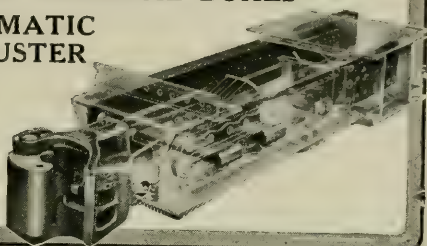
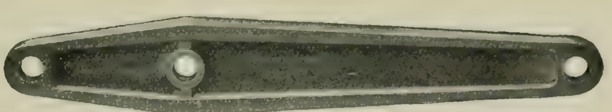
ARC WELDING FOR RAILWAY STRUCTURES

By GILBERT D. FISH, Consulting Engineer, Westinghouse Electric & Manufacturing Company, New York, N. Y.





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D. J. REDDING	November, 1908, to October, 1910
*F. R. McFEATTERS	November, 1910, to October, 1912
A. G. MITCHELL	November, 1912, to October, 1914
*F. M. McNULTY	November, 1914, to October, 1916
J. G. CODE	November, 1916, to October, 1917
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GEORGE D. OGDEN	November, 1923, to October, 1924
A. STUCKI	November, 1924, to October, 1925
F. G. MINNICK	November, 1925, to October, 1926

*—Deceased.

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF MEETING

September 22, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 7:00 o'clock p. m. (Eastern Standard Time), by the Secretary in the absence from the city of the President and Vice President. Mr. Samuel Lynn, a past president, was called to the chair.

The following gentlemen registered:

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Adams, Lewis
Adams, W. A.
Allen, Harvey
Allison, John
Altsman, W. H.
Baer, Harry L.
Berghane, A. L.
Berg, Karl
Beam, E. J.
Bonhoff, E. L.
Campbell, J. E.
Campbell, J. T.
Cannon, T. E.
Carson, G. E.
Carson, John
Conway, J. D.
Copeland, Thomas T.
Courtney, Harry
Cox, W. E.
Crenner, J. A.
Croke, Thomas F.
Cruikshank, J. C.
Cunningham, W. P.
Davis, Charles S.
Dambach, C. O.
Dempsey, P. W.
Emery, E.
Endsley, Prof. Louis E.
Falkner, A. J.
Fenton, H. H.
Fike, James W.
Geisler, Joseph J.
Hale, Charles E.
Hale, O. R.
Haller, Nelson M.
Hamilton, William
Hansen, William C.
Haskell, B.
Herr, R. D.
Hershey, Q. W.
Hogg, F.
Honsberger, G. W.
Hussong, Albert C.
Kelly, H. B.
Kimling, Carl
Kline, I. N.
Kummer, Joseph H.
Landis, W. C.
Leonard, C. W.
Lobez, P. L.
Long, Walter
Lynn, Samuel
Megogney, Frank M.
Mertz, G. H.
Mitchell, Frank K.
Mitchell, W. S.
Moore, Donald O.
Moses, G. L.
Muir, R. Y.
McKedy, H. V.
Nelson, R. F.
Noble, J. A.
Norris, J. L.
Orchard, Charles
O'Reilly, James A.
O'Toole, J. L.
Painter, C. L.
Patterson, J. E.
Peterson, William
Prouty, E.
Ralston, J. A.
Rauschart, E. A.

Redding, P. E.
Redding, R. D.
Reynolds, D. E.
Sanfillip, P. C.
Schrader, A. P.
Shannon, D. E.
Sharp, H. W.
Sharp, James
Shellenbarger, H. M.
Sheridan, T. F.
Simons, Philip
Smith, Frank D.
Smith, M. A.
Stebler, W. J.
Stevens, L. V.
Trust, J. F.
Tucker, John L.
Van Ryn, William
Van Wormer, G. M.
Weissert, W. J.
Wessel, Harry G.
Wright, O. L.
Wyke, J. W.
Wynn, H. R.
Wynne, F. E.

VISITORS

Arthur, Thomas G.
Beam, R. C.
Becoss, L. G.
Corcoran, James
Crumley, Carl M.
Davis, William B.
Duncan, Neil B.
Fish, Gilbert D.
Flannery, Ed. J.
Goodson, L. J.
Gregory, S. D.
Gunnison, W.
Haller, Jacob
Hildebrand, L. B.
Hill, H. H.
Irwin, R. D.
Justus, I. J.
Kirkpatrick, R. L.
Layton, Alfred C.
Lewis, John H.
Madden, Thomas J.
Meyers, August J.
Mitchell, William J.
Moffitt, V. A.
Murphy, Mack E.
McCarthy, W. A.
McCreery, R. A.
McGaw, William L.
McMillan, A. P.
O'Toole, C. R.
O'Toole, J. L., Jr.
Parry, William J.
Rickel, W. E.
Ringo, G. W.
Serman, Andrew
Skuboll, Maurice
Smith, Edward R.
Stout, E. L.
Thrall, O. B.
Wages, W. H.
Ward, Howard E.
Weimer, R. M.
Weitzel, Fred
Wessel, James
Wilson, George F.

CHAIRMAN LYNN: The roll call will be dispensed with, the record of attendance being obtained from the registration cards.

If there is no objection, the reading of the minutes of the previous meeting will be dispensed with, as they have appeared in printed form.

The Secretary read the following list of applications for membership:

Goodman, O. F., Sales Engineer, Worthington Pump & Machinery Corporation, 407 Oliver Building, Pittsburgh, Pa. Recommended by A. F. Coulter.

Haller, Jacob, Assistant Foreman, Wheel and Axle Department, Pressed Steel Car Company, 1808 James Street, S. S., Pittsburgh, Pa. Recommended by George M. Van Wormer.

Irwin, Robert D., Foreman, Westinghouse Air Brake Company, 521 Holmes Street, Wilkinsburg, Pa. Recommended by G. W. Wildin.

Kirkpatrick, R. L., Traction Apparatus Sales, Westinghouse Electric & Manufacturing Company, 699 Larimer Avenue, Turtle Creek, Pa. Recommended by C. L. Painter.

Lewis, John H., Construction Department, P. & L. E. R. R. Co., Wayne Apartments, Beaver, Pa. Recommended by H. W. Sharp.

Meyers, August J., Locomotive Machinist, Aliquippa Southern Railroad, Vanport, Pa. Recommended by J. D. Conway.

McGaw, William L., Shop Foreman, McKeesport Connecting Railroad, 1407 Manor Avenue, McKeesport, Pa. Recommended by James Sharp.

Wible, T. E., Salesman, Arch Machinery Company, 1005 Park Building, Pittsburgh, Pa. Recommended by Norman Allderdice.

Wilson, George F., Electric Welder, Aliquippa & Southern Railroad Co., Box 520, Monaca, Pa. Recommended by J. D. Conway.

Winwood, Horatio M., Locomotive Engineer, Union Railroad, 1400 Pocono Street, Swissvale, Pa. Recommended by J. E. Patterson.

CHAIRMAN: These applications will be referred to the Executive Committee in due course, and upon approval by them the gentlemen will become members without further action than the payment of the current year's dues.

The Secretary announced the death of the following members of the Club:

Hon. James H. Reed, E. K. Thomas, S. Y. Baldwin.

CHAIRMAN: Appropriate memorial will appear in the Official Proceedings of the Club.

This being the stated time for the appointment of a Nominating Committee, under our rules, to suggest names for officers for the ensuing year, if there is no objection, I will appoint as such committee Messrs. H. B. Kelly, John Allison and E. Emery, and will ask them to confer during the evening and report later at this meeting.

Professor Louis E. Endsley outlined plans, in acceptance of invitation of the Carnegie Steel Company, to visit their Wheel Plant at McKees Rocks, also their Homestead Works, on the afternoon of October 20, 1927, formal announcement of which is to be mailed to the members.

CHAIRMAN: Is there any further business to come before the Club at this time? If not, we will proceed to the paper of the evening. It gives me pleasure at this time to call upon Mr. Gilbert D. Fish, Consulting Engineer, Westinghouse Electric & Manufacturing Co., New York, who will address you upon the subject, "Arc Welding of Structural Steel."

ARC WELDING FOR RAILWAY STRUCTURES

By GILBERT D. FISH,
Consulting Engineer, Westinghouse Electric & Manufacturing Company,
New York, N. Y.

The application of arc welding to steel railway structures is a natural sequel to the recent developments in building construction and heavy manufacturing.

The integrity of arc welded connections correctly designed and executed under proper control has been established. Whereever structural steel parts are to be joined permanently together, the electric arc process is suitable for the purpose.

The analysis of welded joints, although still in the research stage, is inherently more definite than that of riveted or bolted ones, because of the continuity of metal through the junctions. We know enough about the properties of welded joints at this time to design and detail welded structures economically according to definite standards, and the testing and research now in progress are enabling us from month to month to refine our designing methods and reduce excessive safety factors.

Welded joints will prove more permanent under severe conditions of moving loads and stress reversals than riveted ones, owing to their immovability. Doubt is frequently expressed as to the fatigue and shock resistance of weld metal,

laboratory tests having shown that the cast steel forming a weld is somewhat inferior to rolled steel in respect to these factors. What counts is that the properly designed welded joint, in which no part suffers strains beyond the elastic limit, has a joint resistance to impact and fatigue far superior to the non-continuous riveted joint in which rivets are stretched and connection angles twisted by sudden and frequently repeated deflections of one or more of the connected members.

Continuity or fixedness of welded joints brings into use the elastic, or "rigid," frame, with its economy of material,

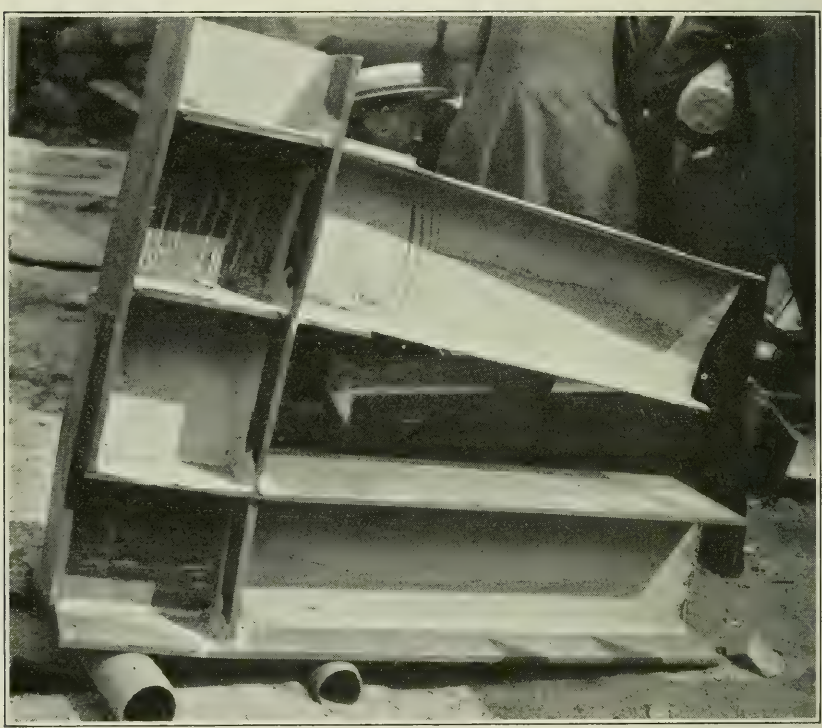


FIG. 1.

elimination of play at joints, minimum deflection and vibration, and reduced cracking of fireproofing material and plaster if used. The elaboration of design calculations for the elastic frame places an extra burden on the designing engineer, but the elimination of rivet holes greatly reduces the work of the detailer and steel shop draftsman.

The change from riveted to welded construction, now in

its early stages but taking place at increasing speed, calls for changes in the instruction of professional engineering students and for study on the part of practicing engineers. There is need for a text book covering welded construction in its present state, and steps are being taken to meet this need.

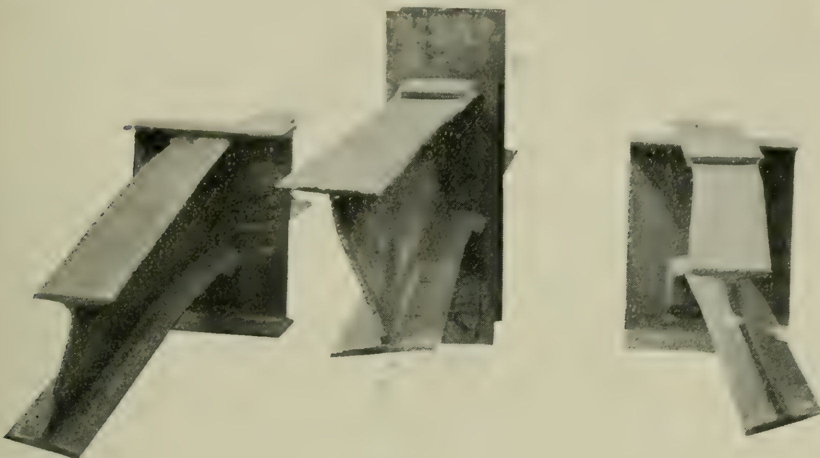


FIG. 2.

The reasons for preferring welding to riveting in structural work are its comparative economy, its availability for some purposes not served by riveting, its properties whereby the bending and tensile strength of the members joined may be fully developed, its reduction of dead weight and bulk of steel

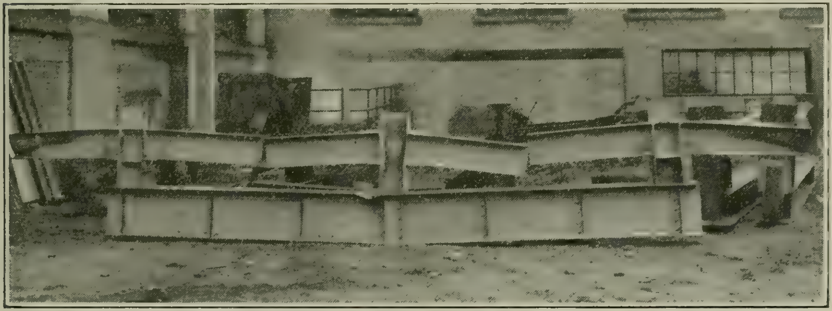


FIG. 3.

required, and its silence. All these features will be illustrated in this paper.

The Westinghouse tests at the Carnegie Institute of Technology in Pittsburgh in July, 1926 proved that arc welded structural joints could be made stronger than any possible

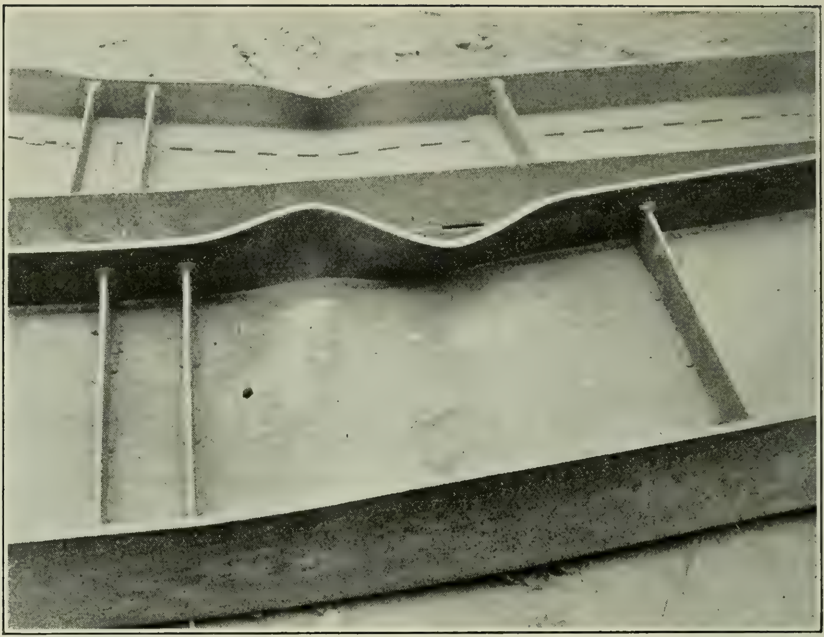


FIG. 4.

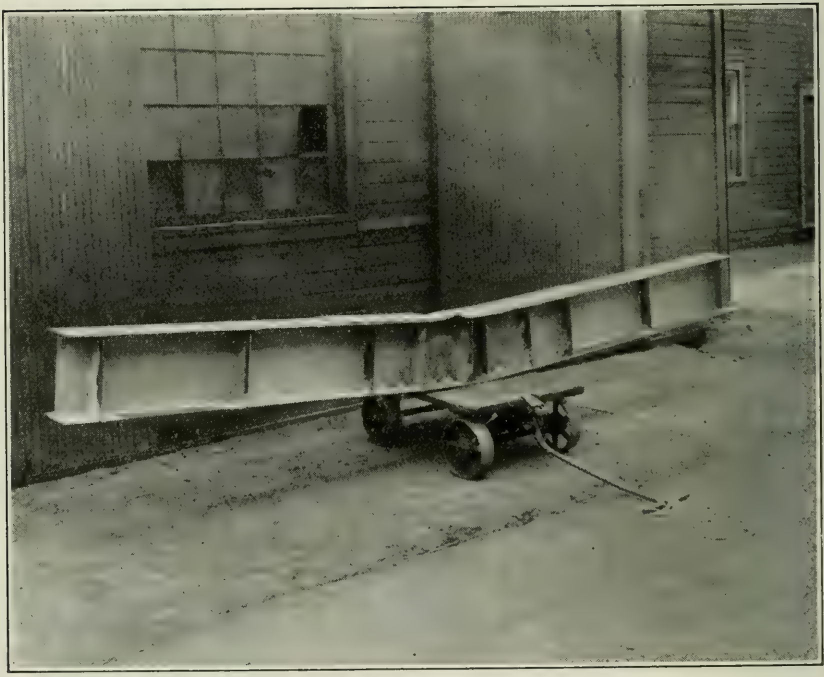


FIG. 5.

riveted joints. Figs. 1 and 2 show cantilever joints which developed the ultimate bending resistance of the cantilever arms, a performance not to be matched by riveted joints regardless of number, size or arrangement of rivets and connecting parts. These and similar tests paved the way for the first use of fully continuous beams and girders in steel building construction, which occurred in the Sharon Building. This statement is made with due respect to the prior use of cantilever beam construction in riveted buildings and the familiar continuous plate girder of turn-tables and deck bridges. Figs. 3 to 5 show a

FIG. 6.

riveted plate girder, a welded plate girder made up of duplicate parts, and a welded girder of the same depth as the other two made only of plates. The welded girder made of plates and angles developed 9% greater ultimate resistance under concentrated center load than the riveted girder, due probably to

the welds connecting the flange angles directly to each other at their heels. The girder made of plates only weighed the same as the riveted girder but developed 55% greater ultimate

FIG. 7.

resistance due to its greater section modulus and its stiffer compression flange.

Fig. 6 shows the Sharon Building of the Westinghouse Company. Figs. 7 and 8 are views of the massive plate girders carrying five tiers of that building across the 45 foot crane

runway. Fig. 9 illustrates a typical interior column joint, with two 15-inch beams and two 20-inch girders fixed by welding to the column so that full continuity is developed in both directions; absence of continuity as in riveted construction would have necessitated 18-inch instead of 15-inch beams and 24-inch

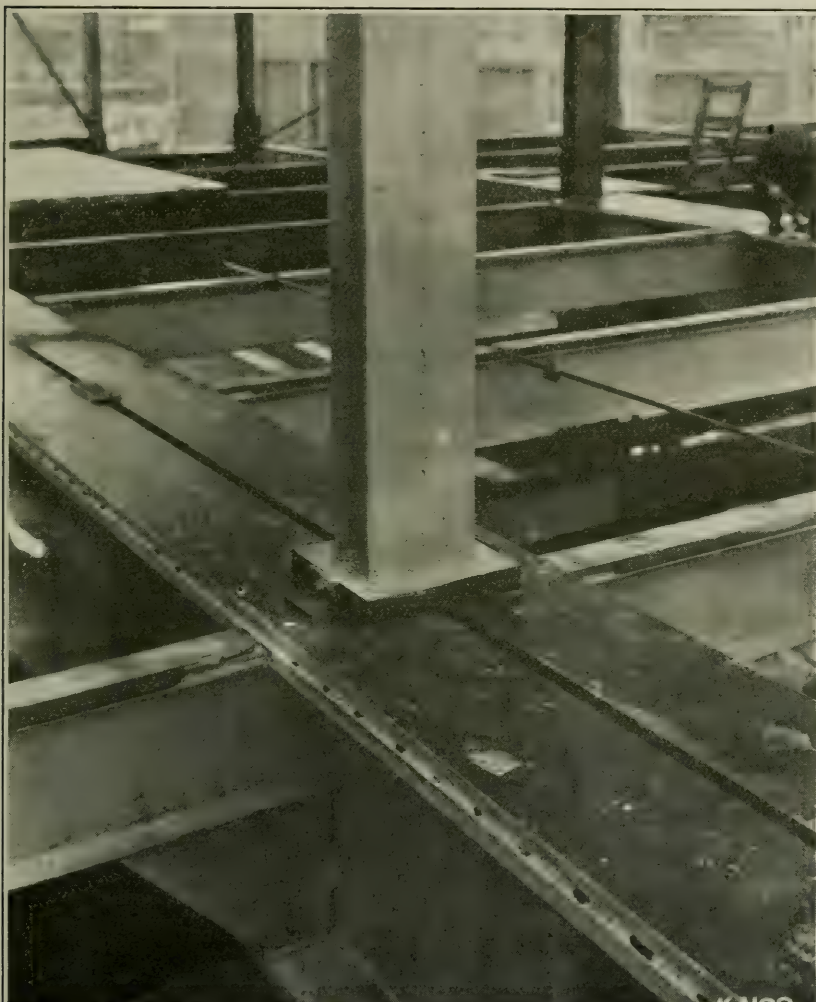


FIG. 8.

instead of 20-inch girders. Welded construction saved 100 tons of steel in this 800-ton structure.

Figs. 10 and 11 are views of the welded building at Derry, Pa., which was constructed of 135 tons of fabricated steel and 200

tons of plain material shipped directly from mill to job. The purlins were made fully continuous by the welding, but the rafters could not be made continuous because they were at different elevations. The welded design required 10% less

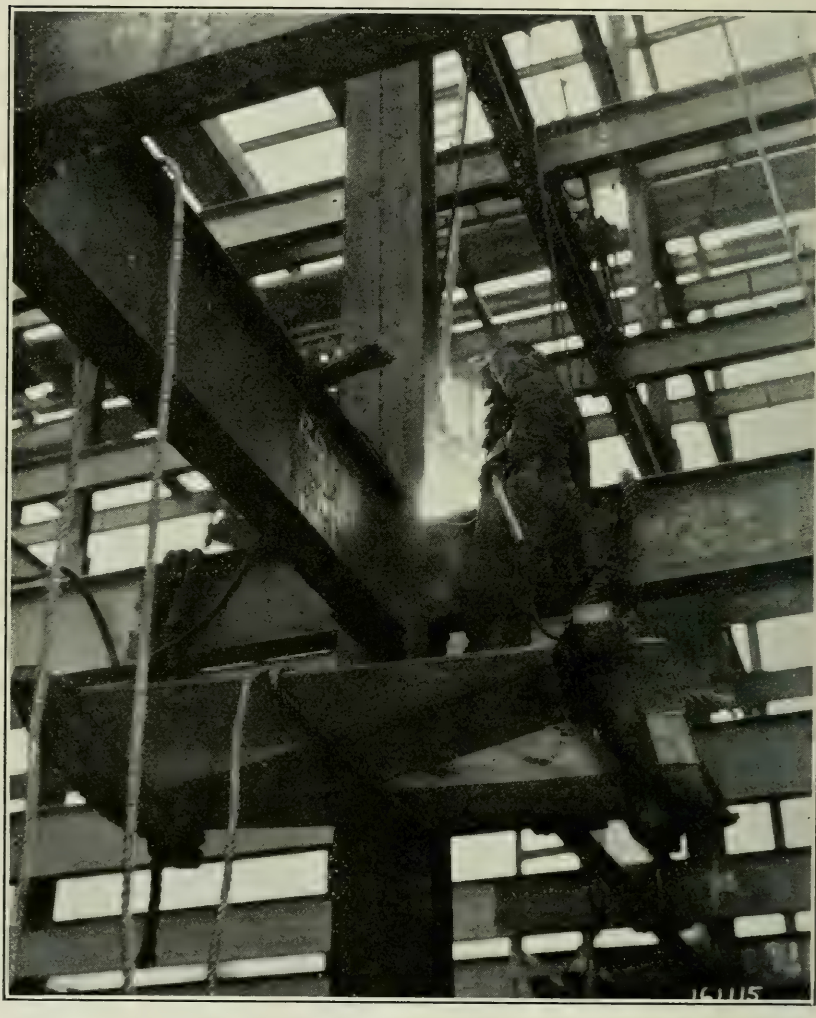


FIG. 9.

steel than the riveted design on which comparative bids were taken, and the cost to the owner was approximately 10% less than the bid of the same contractor on the riveted design.

The principal uses for are welding in railroad work are: (1) Miscellaneous shop work on locomotives and cars, es-

pecially repairs and building up worn parts such as wheels.

(2) Maintenance of way, particularly building up worn frogs and switch rails.

(3) Construction of miscellaneous steel structures such as signal bridges, switch towers, catenary supporting bridges on electric lines, transmission towers, water towers and tanks.

(4) Construction of buildings such as machine shops, tool houses, train sheds and stations.

FIG. 10.

(5) Constructing steel bridges, trestles, viaducts and turntables.

(6) Reconstruction and reinforcement of bridges to carry increased train loads or to restore original strength after deterioration.

(7) Construction of locomotives and cars.

Arc welding for repair purposes has been going on in railroad shops for some years. All railroads, I believe, have arc welding equipment, and its use for building up worn wheels, repairing cracked cylinder and fireboxes, fastening boiler tubes to tube sheets, and repairing broken parts of locomotives and shop machinery is too well established to require detailed discussion here. The use of arc welding in locomotive boiler construction is being developed. Many welded tanks are in use

FIG. 11.

by railroands. Extensive use of the arc is being made for building up manganese steel frogs in railroad yards. The joining of rails by welding is very common where track is embedded in concrete or pavement, and the arc method is generally employed for this purpose. The C. B. & Q. Railroad has built half a dozen small arc welded buildings; as welded buildings have already been discussed sufficiently for the purpose of this paper,

further reference to them will not be made except to point out that railroads are suitably organized to construct welded buildings of unfabricated steel, using their own labor and sometimes drawing on the steel scrap pile.

Light steel structures such as signal bridges and towers are an attractive field for welding. Many parts of such frames, when designed for riveting, are made of angles with legs 2½ inches wide to take ¾ inch rivets and ⅜ inch thick to withstand weathering, where angles of the same thickness but with narrower legs or narrow bars ⅜ inch thick would serve the purpose if welded. Again, the tension value of a small angle or lattice bar connected by rivets in one leg only is very small in relation to its weight, and welded connections for such members save a large percentage of weight. Further, the fabrication cost is relatively high in these light frames when riveted, whereas such structures if welded can be built on the floor of a shop with the use of jigs and entirely without punching. I have recently designed for welding a four track signal bridge which required 25,000 pounds of steel according to the railroad standard for riveted construction; the design for welding required less than 10,000 pounds, although standard working stresses were figured and the ⅜ inch minimum thickness rule was observed; part of the difference was due to many parts of the riveted design being unnecessarily heavy in order to match corresponding parts of the eight-track bridge, but most of the saving in the welded design was due to the economy of material inherent in welded design. Struts and braces carrying slight loads can often be made lighter when connected by welding, because of the superior fixation of the ends. Main compression members of bents and trusses may be reduced by subdividing panels with cross braces welded in place, this procedure being economical in many cases where it would not pay to introduce extra fabricated pieces. Gussets are almost entirely eliminated from truss and bent construction in this class of work. Avoidance of gussets and reduction in cross section of members reduce both dead load and wind load stresses and in the case of overhead structures on railroads have the additional advantage of improving visibility. Cost of maintenance is somewhat reduced due to saving in the painting item, the surface of metal being less and the absence of rivet heads lowering the labor cost of brush painting and doing away with the points of worst corrosion. The Pullman Company has effected savings of 50% in cost of electric transmission towers by substituting arc welding

for riveting. The Mississippi Valley Structural Steel Company is manufacturing roof trusses by arc welding on the floor of one of its shops and reports cost savings. Within the last month I have brought together an oil company and a steel shop on a project for shop manufacture of standardized small buildings for erection at scattered points, the building frame to be shop welded in panels and bolted together in the field. The Westinghouse Company is welding all frames and bases for its transformers built at the Sharon Works, and the savings realized at that plant due to replacement of riveting are estimated at $20,000 a month, with further economies in view due to improved designs and extension of automatic welding. Generally, in light steel construction with considerable repetition of pattern, where most of the work can be done in the shop with the aid of jigs, the replacement of riveting by welding can be made to save about half the cost of riveted construction, with increased stiffness of the structures and without any disadvantages.

The most interesting applications of arc welding in railroad work are the construction and reconstruction of bridges and viaducts. Few bridges built during the last century were designed for such heavy loads as they now carry; furthermore, most bridges become weakened by corrosion. At present, nearly all railroad bridges except those built within the last few years are overloaded, in many cases 50% beyond standard specifications for new bridges. The more serious cases cannot be remedied by riveted reinforcement, because the cost of such operations would exceed the cost of new bridges and because major alterations would close the bridges to traffic; less serious cases may be reinforced by riveting, usually at very high expense and rarely without impeding traffic. Even minor reinforcements usually weaken some of the members temporarily and require interruptions of traffic or reduced speed of trains. On multi-track bridges the floor systems may be reinforced by introducing additional stringers and by riveting extra cover plates to the floor beams, one track at a time being closed to traffic. Where flange angles are badly corroded or cracked, they cannot be restored by riveted reinforcement but must be replaced. The situation as described to me by a number of railroad bridge engineers is a serious economic problem for the railroad companies, which are faced with the necessity to replace a majority of their bridges within a limited number of years unless they turn to

welding as a means of reinforcing the old structures. This alternative is sure to be adopted, for reasons which I will point out.

In further reference to the resistance of arc welded joints to fatigue, a Westinghouse test which has been reported in previous technical papers is here mentioned; it was planned and executed by Mr. A. G. Bissell, welding engineer. A vibration machine imparted 1760 short vertical vibrations per minute to riveted and welded cantilever beams. The riveted joints with top and bottom angles were both broken by failure of the angles within the first 75,000 vibrations, while those with the small side angles merely loosened by stretching of the rivets and reduction of their diameters, as in the case of the upper rivets in the connections of bridge stringers to floor beams. The first 2,000,000 vibrations had no apparent effect on the welded joints, and weights were then welded to the ends of the arms to accelerate the test. 2,000,000 additional vibrations broke the supporting column, but the welds remained intact. This test illustrates the higher resistance of welded joints to repetition and reversal of stress, this advantage being due not to any superior fatigue limit of weld metal but to the elimination of motion beyond the elastic strain limit; parts brought into contact or continuity by welding cannot separate without breaking the welds, and if the welds are strong enough at first they remain so. Structural welding practice is not old enough for us to know definitely how much more rapidly, if any, the safety factors in weld metal decrease due to reptition of stress than do the safety factors in the rolled steel, but the roughly approximate information derived from laboratory tests and from the performances of welds which have endured shock duty for considerable periods of years, definitely places this question among those which for the present are sufficiently covered by the use of liberal safety factors in designing welds. Shock tests under the steam hammer have shown how structural steel frames with liberally welded joints fail by distortion of the members and have inspired us with complete confidence that welded structures designed according to our present standards will fail, if at all, only by gradual crippling of the rolled steel members under extreme loads. In short, the properties of welded joints make possible the development of the full strength of the members joined whenever this is advantageous; the same is not nearly true of riveted joints. The above statement holds whether the strength be with reference to static loads, impact, reversal of stress or indefinite repetition of applied forces. It should be

realized that it is not always advisable to design welded joints for complete continuity, the reason against doing so in any given case being either that a rigid connection would result in objectionable stresses in one or more of the connected members or that the cost of welding the connection would be too high for the advantages gained; in some such cases it is necessary to provide against dangerous secondary stresses in the welds which might be set up by the deflecting of the members or (under special condition) by temperature changes; generally the provision against such danger consists in using connection members such as angles, which can yield sufficietly in torsion or flexure to allow the main members to suffer deflection without dangerous secondary stresses being set up. Ordinary riveted connections in buildings would commonly fail if it were not for the flexibility of connection angles and the extensibility of rivets.

Certain operations readily performed by welding but difficult or impracticable by any other means will be listed as including the principal means for reinforcing bridges with the electric arc:

(1) Welding plates, bars, angles, rails or other shapes to main members. The old metal is not weakened either temporarily or permanently by the operation and traffic need not be delayed; in care of a tension member the welding, which is usually intermittent, should be done progressively from one end to the other to avoid breaking the welds when the partly reinforced member is strained by a passing train. In case of a compression member, sufficient reinforcement can often be accomplished by increasing the sectional area and radius of gyration throughout part of the length of the member.

(2) Welding tension members to gussets so as partly to unload them between edges of gussets and nearest rivets, thus making a larger percentage of cross sectional area available for resisting stress.

(3) Reinforcing joints by welding members directly to each other so as to relieve the gussets, or welding additional plates or bars at the joints to reinforce the gussets.

(4) Welding extra bracing members to the trusses in such positions as to reduce the length ratios of compression members.

(5) Welding existing stringers to floor beams in such manner as to develop continuity of beam action, thus increasing stringer carrying capacity 25 to 50 per cent.

(6) Reinforcing stringers and floor beams by welding additional plates or angles to the flanges and by welding stiffener

plates to the webs if necessary to increase buckling resistance and by welding shear plates to the webs if necessary to provide for heavier reactions.

In view of the fact that these operations can generally be carried on without removing old parts and without chipping off rivet heads, it is evident that there need be no temporary weakening of the structure as in most reinforcing work by riveting. Furthermore, welded reinforcement can generally be arranged to avoid taking up or obstructing the track, although this may involve awkward overhead welding where it is necessary to reinforce top flanges of stringers or floor beams. The features just mentioned, together with the possibility of welding new material to badly corroded members, the less quantity of new material required and the avoidance of removing rivets and of drilling and reaming holes, make the welding method far cheaper than riveting for reinforcing bridges and make possible the reclamation of many structures which must otherwise be replaced. Such large sums of money are at stake that it will pay all railroads that have not yet investigated these possibilities to do so before proceeding with further alterations or condemnations of old bridges.

The American Bridge Company recently completed extensive arc welded reinforcement of the Great Western bridge across the Missouri River at Leavenworth. This operation, which saved a large part of the expense which would have been involved according to the original plans, was the first application of arc welding for major alteration of a railroad bridge, at least in this country. Several months earlier the Neeld Construction Company of Pittsburgh reinforced and double-decked the long Highway bridge over the Susquehanna River at Havre-de-Grace, using arc welding exclusively for field connections.

For new bridge construction, welding permits great economy of material for several reasons. Stringers are made continuous, with consequent saving averaging about 20% in weight of stringers. Flexural members other than rolled beams, whether acting as stringers, floor beams, top lateral crossbeams or main girders in plate girder spans, require less material if designed for welded assembly than otherwise, because the best type of welded plate girder uses plate material only and has a greater section modulus than a plate and angle girder of the same weight and depth. Tension members of trusses are designed without deductions for rivet holes, such deductions in riveted designs frequently amounting to 25%. The small amount of

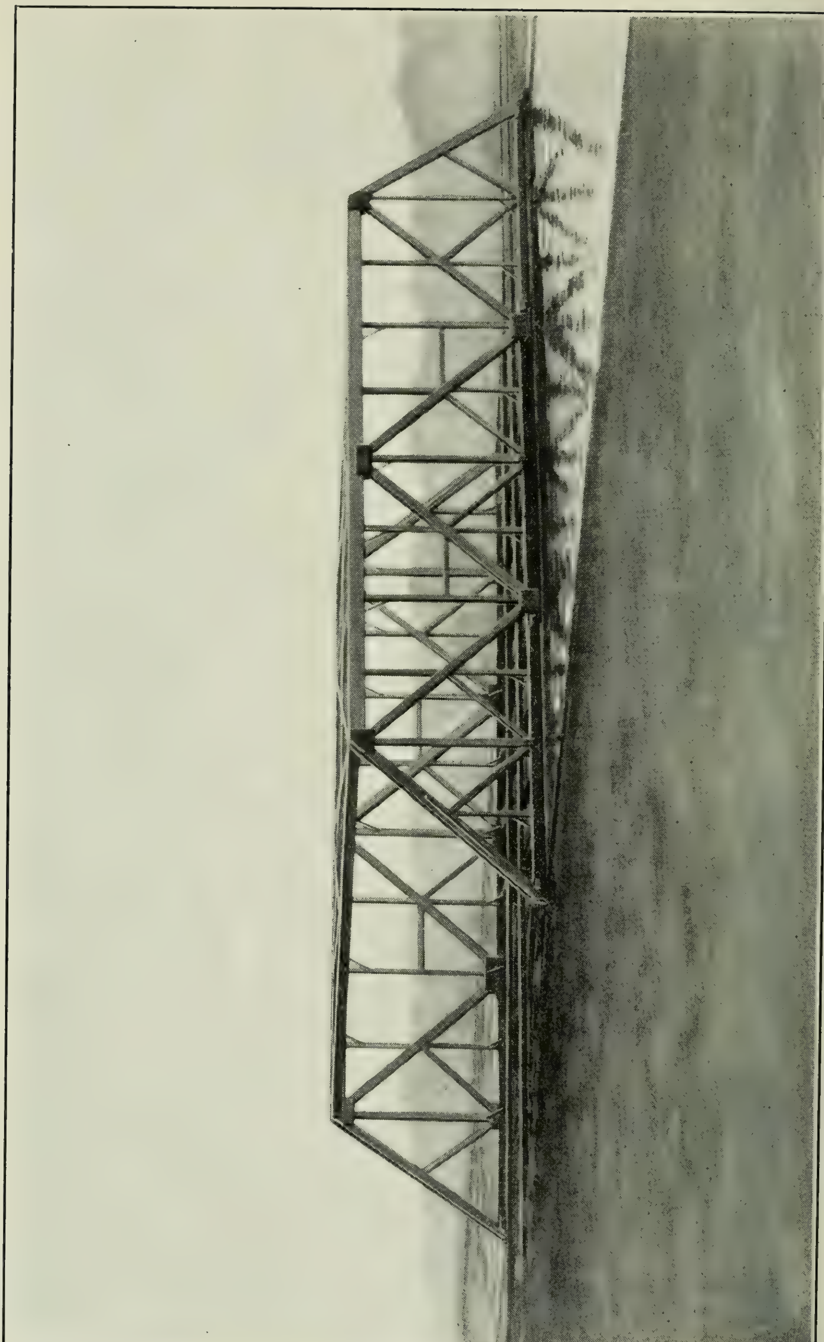


FIG. 12.

labor required to weld in place a light brace provides opportunity to reduce the unsupported lengths of long compression members and therefore to reduce their weights. The largest item of material saving is the elimination of most of the connection material, which amounts to 30% of the total weight of steel in many riveted bridges. The lightness of the welded bridge means smaller dead load stresses than for the riveted one, and this is in itself an additional basis for weight saving.

Fig. 12 shows a welded bridge designed to carry a spur of the Boston & Maine Railroad across a canal into the plant of the Westinghouse Electric & Mfg. Co. at Chicopee Falls, Mass. The design has been approved by the railroad and proposals for construction are expected this week. This is a single track through span with extreme skew, each truss being 135 feet long. The live loading is Cooper's E 50. The bridge was first designed for riveting, with Cooper's E 60 loading, this design requiring 140 tons of steel. For E 50, the riveted design would require about 120 tons. The welded design calls for 80 tons, saving one-third in material. The weight saving is due to omitting most of the connection material, utilizing gross section of tension members, 30% reduction of dead load stresses, use of extra brace members to reduce length ratios of compression members, and continuity of stringers. The center line dimensions were made the same as for the riveted design, but rolled sections of the H-column type have been substituted for built up sections throughout.

It is believed that this will be the first welded railroad bridge. Details of the design may therefore be interesting to structural engineers and steel men. Fig. 13 shows an end joint detail a 4½ inch pin is set in a hole drilled through the end post H section and welded in place; both flanges and the web bear on the pin. The pin pedestal is made of two 1½ inch plates having semi-circular notches to carry the full vertical truss reaction transmitted by the pin, with two 1 inch plates welded between the pin plates to brace them. All four plates are welded to the 1 inch sole plates. The sole plates have slotted holes where the anchors go through, and ⅛ inch brass is used between sole plate and cast iron pedestal to permit sliding with temperature change. The pedestal, which is partly embedded in concrete abutment, is made of cast iron to resist rust, the top of the abutment being only a few inches above the water line. The bottom chord tension is developed mainly by butt welding the chord flanges to the flanges of the end post; the

ends of the chord flanges are beveled 45 degrees to facilitate butt welding, and the obliquity of the weld with respect to the axis of the chord permits assigning to the weld the same strength

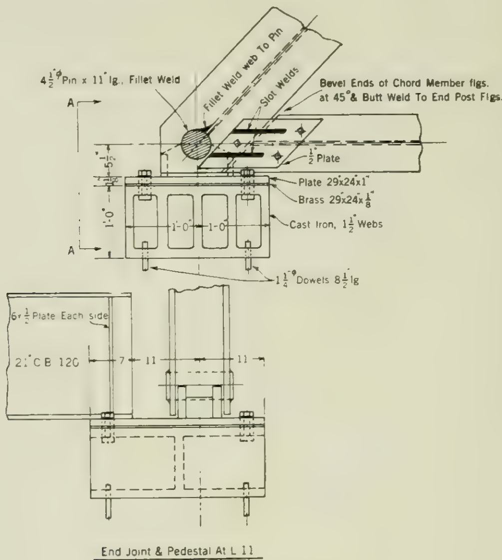


FIG. 13.

as that of the flanges themselves to resist axial stress. The additional tension carried by the web of the chord member is transferred across the joint by the strap plates; these are welded

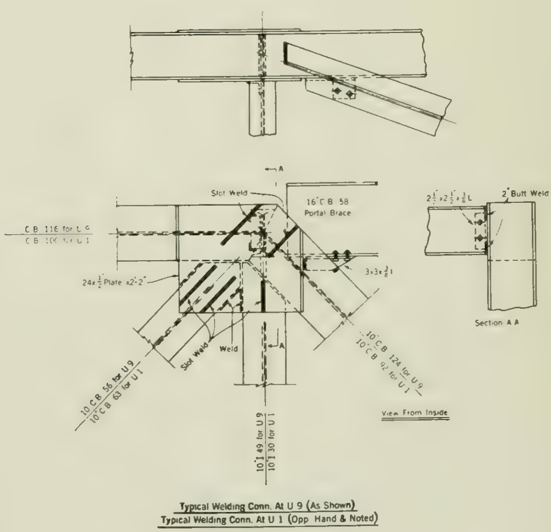
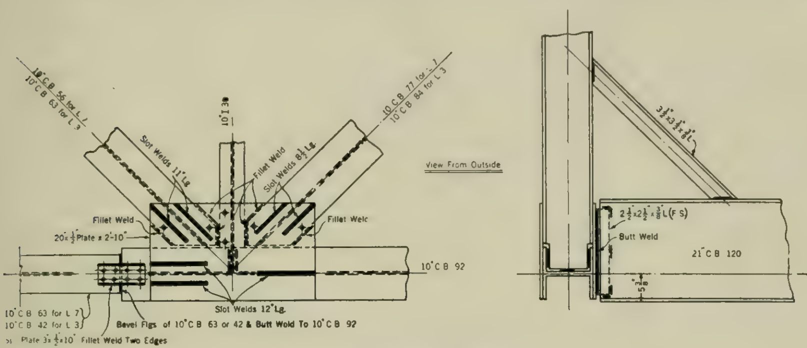


FIG. 14.

not only along the horizontal edges but also through the slots. which are ½ inch square in section. There plates are bolted to the members for erection purposes.

Figs. 14 and 15 show other truss joints. In all top chord joints the chord members are milled to bear, and the welds are utilized to transfer the web member stresses and to hold the chord

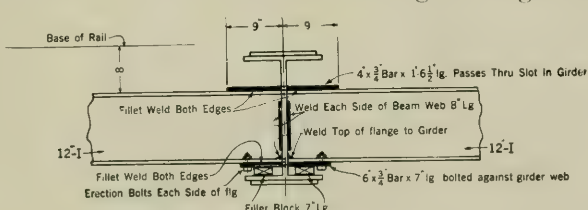


Typical Welding Conn. At L 7 (As Shown)
Typical Welding Conn. At L 3 (Opp. Hand & Noted)

FIG. 15.

members firmly. Where slot welds are used, the section of gusset plate cut away to form the slot is restored by the weld metal, which is nearly as strong as the plate metal and causes no weakness in effect because the welds do not lie in critical sections of the plate.

Fig. 16 shows a typical stringer-to-floor-beam connection. The continuity is developed by a tension plate passing through a slot in the beam web and welded along its edges to the top



Stringer Beams Cold Sawed to allow abt. ⅛" clearance each end

Typical Welding Conn. Of Stringers To Floor Beams

FIG. 16.

flanges of the stringers, and by butt plates below which also serve as erection seats. The webb weld is for vertical reaction. If full continuity were not developed it would be usafe to carry the end reaction by means of a weld between the stringer web and the supporting beam, because the deflection of the stringer

under live load would be likely to crack the weld. A safer procedure, in any case where it might be impracticable to develop continuity, would be to use side framing angles with welds at the outer edges, thus providing a flexible element which would accommodate the stringer deflection by yielding slightly in torsion at each application of live load. In riveted work the upper rivets connecting framing angles to supporting beam usually stretch, thus relieving considerably the torsional fatigue in the angles but throwing most of the load upon the lower rivets.

The specifications for painting this bridge are that all material shall receive one shop coat of linseed oil, one field coat of red lead and oil and one field coat of graphite paint, except that surfaces brought into contact in shop assembly shall be painted with red lead before assembly. Linseed oil, unless applied too heavily, does not interfere with welding; red lead delays welding, and graphite or asphaltic paints require every welding bead to be run twice, the first one doing little more than burn away the paint.

An arc welding field which will be of great importance in railroading when it becomes common is steel car construction. There are unlike structures such as buildings and bridges in that they are shop assembled, that they involve articulation of mechanical with structural parts, and that impact loads and other forces not accurately calculable are large in relation to the static loads. These two distinctive features make the welded car problem very different from those relating to buildings and bridges. Shop production of standardized articles such as a batch of cars naturally involves jigs; as applied to welded construction it nearly if not quite does away with holes for assembly bolts; it places a premium on careful design because one design is used repeatedly, and it lends itself to accurate cost analysis. Automatic welding will play an important part because of high speed, and special mechanical carriages for the automatic welding machinery will be developed to meet the need for mass production. Uncertainty as to the stresses to be resisted will require car design to remain largely enpirical so far as the proportioning of the parts is concerned, but the amount and arrangement of welds to connect a given combination of parts need not be empirical. The nature of the service to which cars are put is very variable, and experimental work on actual construction followed by observation in use is especially necessary to develop welded car construction. The Westinghouse Company and a car manufacturing company have for

some time been conferring on the proposed construction and trial use of a group of welded oil tank cars, and some special tests of welded joints have been carried out with this in view, the results so far having been highly satisfactory.

The steady replacement of the rivet by the electric arc is a great economic movement which cannot be checked by skepticism as to the dependability of the process. The results can be definitely controlled, and failures are as definitely preventable as they are in other engineering operations. The interests of some businesses will be adversely affected by the passing of older methods, but the change is not occurring abruptly like the enactment or repeal of a tariff and need not wreck any business of which the managers recognize early the trend to welding. The bolt for connecting parts which must remain separable will stay among us, but the rivet is passing. Can any engineer observe what has already been done and doubt this?

CHAIRMAN: Gentlemen, you have heard a very interesting as well as instructive paper and as it is our custom to have a discussion of papers presented, this paper is now before you for discussion. However, I desire to announce at this time that the regular pick-up luncheon has been prepared and we desire to dispose of the luncheon promptly. As you no doubt know, we are expecting to have the Big Fight broadcasted and I will therefore ask you to be brief and direct in your discussion of the paper.

MR. FISH: Mr. President, may I make the suggestion that in the absence of very much time for discussion, if any of those present are concerned about some point which has been raised and would like further information, or would like to take issue with any of the statements made, I should be pleased to correspond with any such. My address is 150 Broadway, New York.

CHAIRMAN: I would like to add that the Secretary will be glad to receive for publication any written discussion that you may wish to contribute.

Professor Endsley, have you anything to say on the subject?

PROFESSOR L. E. ENDSLEY: Mr. President, we have had before us tonight a man who is well posted on his subject, and has put it before us in a way that does not leave us very much to talk about. It has been a very enlightening paper. But

I feel that it is a little like meeting not so long ago where the fellows told us that the locomotives would soon all be electric. They have not as yet. I think we will continue to use a few rivets in freight cars for a while. But I would like to see one of those welded freight cars. I believe you can save metal. And if there is any place where we would like to save metal it is in a freight car. What you can take out of the car you do not have to haul around, and it is the cost of hauling around that weight, that counts. And I would think the saving in weight in freight cars and locomotives by the welding process, would be a great argument with the railroads.

I have enjoyed the paper very much.

CHAIRMAN: Has any other member anything to say on the paper before we take up the next item of business? As there does not appear to be any further discussion, I will now call on the Nominating Committee for their report.

MR. H. B. KELLY, Chairman, read the report of the Nominating Committee, as follows:

President

E. J. Devans, General Superintendent, Buffalo, Rochester & Pittsburgh Railway Company.

First Vice President

F. W. Hankins, Chief of Motive Power, Pennsylvania Railroad System.

Second Vice President

W. S. McAbee, General Superintendent, Union Railroad Co.

Secretary

J. D. Conway.

Treasurer

E. J. Searles.

Executive Committee

(8 to elect) L. H. Turner, Frank J. Lanahan, D. J. Redding, A. Stucki, Samuel Lynn, D. F. Crawford, F. G. Minnick, G. W. Wildin.

Membership Committee

(To serve 3 years) Otis R. Hale, E. A. Rauschart.

Subject Committee

(To serve 3 years) A. M. Candy.

Finance Committee

(To serve 3 years) T. M. Blakley, J. H. Carroll, Jr., W. P. Cunningham, W. C. Hansen.

Reception Committee

(To serve 3 years) O. L. Wright.

SECRETARY: It should possibly be explained that the members whose terms have not yet expired, who will serve for another year, or possibly two, have not been included in the list of nominations and such names will not appear on the ballots, and I may also explain that Mr. Stark, who has served the Club as Treasurer for many years, has requested to be relieved of that duty at the expiration of the fiscal year, October, 1927.

CHAIRMAN: In connection with the report of the committee which has just been read, as is the custom, regular printed ballots will be sent to each of the members for voting. If any member desires to vote for a member whose name does not appear on the ballot, he is privileged to do so, and to insert on the ballot the name of any member he wishes to vote for for any office. The report of the Nominating Committee is only a suggestion, and is not to be understood as in any way preventing your voting for any one else.

The next meeting is the annual election and smoker. The Secretary assures me that the various committees charged with responsibility for our entertainment on that evening have their work well in hand and they hope to have something even better than we have hitherto had.

Is there any further business?

MR. EMERY: If there is no further business, I would like to suggest a rising vote of thanks to Mr. Fish for the splendid and complete paper he has so kindly given us tonight.

The motion prevailed by unanimous rising vote.

There being no further business, upon motion, adjourned.

J. D. CONWAY, Secretary.

In Memoriam

HON. JAMES H. REED,
Died June 17, 1927.

E. K. THOMAS,
Died July 3, 1927.

S. Y. BALDWIN,
Died August 23, 1927

INDEX OF

PAPERS AND THEIR AUTHORS

PRESENTED BEFORE RAILWAY CLUBS DURING THE SEASON OF 1926-1927
COMPILED BY THE SOCIETY OF RAILWAY CLUB SECRETARIES

THE RAILWAY CLUB OF PITTSBURGH

John D. Conway, 515 Grandview Ave., Pittsburgh, Pa., Secretary

September 23, 1926—"Lubricants." By *M. D. Hersey, Physicist, United States Bureau of Mines, Pittsburgh, Pa.*

October 28, 1926—Annual Meeting.

November 29, 1926—"The Human Element in Industry." By *E. S. McClelland, Director of Personnel, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

December 23, 1926—"Car Retarding Systems in Connection with the Operation of Hump Yards." By *W. B. Rudd, Engineer, Union Switch & Signal Company, Swissvale, Pa.*

January 27, 1927—"Transportation and Education." By *F. L. Bishop, Dean, School of Engineering—School of Mines, University of Pittsburgh, Pa.*

February 24, 1927—"Current Railroad Affairs." By *E. T. Whiter, Vice President, Central Region, Pennsylvania Railroad System, Pittsburgh, Pa.*

March 24, 1927—"Alloy Steels in the Railroads." By *F. J. Griffiths, Chairman, Board of Directors, Central Alloy Steel Corporation, Massillon, O.*

April 28, 1927—"Corrosion and Pitting in Locomotive Boilers." By *C. A. Seley, Consulting Engineer, Locomotive Firebox Company, Chicago, Ill.*

May 26, 1927—"Diesel Locomotives." By *L. G. Coleman, Manager, Locomotive Department, Ingersoll-Rand Company, New York, N. Y.*

NEW YORK RAILROAD CLUB

Harry D. Vought, Room 404, 26 Cortlandt St., New York City, Secretary

September 17, 1926—"Railway Equipment Problems." By *Frank H. Hardin, Assistant to the President, N. Y. C. R. R.*

October 15, 1926—"The Railroad and its Training Problems." By *Prof. N. Miller, Director of Industrial Extension Division, Rutgers College.*

November 19, 1926—"The Relation of Transportation to Electrical Development." By *Frederick Darlington, Assistant to Vice President, Westinghouse E. & M. Co.*

December 16, 1926—No meeting. Annual Christmas Dinner.

January 21, 1927—"Modern Locomotive Design and its Influence Upon Railway Operation." By *W. E. Woodard, Vice President, Lima Locomotive Works.*

February 18, 1927—"Training Understudies for Official Positions in Railroad Service." By *Prof. William J. Cunningham, James J. Hill, Professor of Transportation, Harvard University, Graduate School of Business Administration.*

March 18, 1927—"A Practical Talk on Building an Effective Organization." By *Dr. Lillian Gilbreth, President, Gilbreth Incorporated.*

April 15, 1927—"Light Ray and the Electron." By *Dr. E. F. Alexanderson, of the General Electric Company* and *Consulting Engineer of the Radio Corporation of America.*

May 20, 1927—"Yard Operation by the Car Retarder Operation." By *W. B. Rudd, Union Switch & Signal Company, and W. K. Howe, General Railway Signal Company.*

CENTRAL RAILWAY CLUB OF BUFFALO

Harry D. Vought, 26 Cortlandt St., New York City,
Secretary-Treasurer

September 9, 1926—"Proper Methods of Loading and Handling of Perishable Freight at Terminals." By *Horace Franklin Pierce, Perishable Freight Inspector, Pennsylvania Railroad, Buffalo.*

October 14, 1926—"Operation of Passenger Trains Without the Use of Angle Cocks." By *W. H. Sitterly, General Car Inspector, Pennsylvania Railroad, Buffalo.*

November 11, 1926—"Oxygen the Wonder Worker." By *G. E. Harcke, Engineer, Air Reduction Sales Company.*

December 9, 1926—"Terminal Improvements In and About Buffalo." By *W. F. Jordan, Principal Assistant Engineer, New York Central Railroad.*

January 13, 1927—Annual Meeting and Dinner. Toastmaster, *M. H. Hassett; addresses by A. E. Calkins, retiring President; the Rev. James Cosbey, Rector of the Church of the Good Shepard, Buffalo, and G. M. Shriver, Senior Vice President, Baltimore & Ohio Railroad.*

February 10, 1927—Old Timers Night. Informal addresses by *Samuel B. Newton, Division Passenger Agent of the Pennsylvania Railroad; Fred C. Ganson, Thomas F. Toughey, Charles H. Hogan, T. J. Hartnett, Road Foreman of Engines of the Lackawanna; Thomas J. O'Donnell, Assistant Secretary, and Harry D. Vought, Secretary-Treasurer of the Club; Harry G. Gaston, Agent, Lackawanna Railroad, Buffalo, and Clarence D. Taylor, Vice President, Buffalo Storage & Carting Co., Buffalo.*

March 10, 1927—"Manufacture of Rolled Steel Wheels and Mass Production of Freight Cars." By *A. G. Richardson, Manager, Technical Publicity Department, Bethlehem Steel Corporation.*

WESTERN RAILWAY CLUB

W. J. Dickinson, 189 W. Madison St., Chicago, Ill.
Secretary

September, 1926—"Serving the Public, the Key to Successful Railroad Operation." By *Col. W. G. Edens, Vice President, Central Trust Company.*

October, 1926—"The Adaption of Industrial Research to Railroads." By *Harry G. Miller, Editor, Railway Review.*

November, 1926—"Chicago Terminal Improvement of the Illinois Central Railroad." By *C. H. Mottier, Engineer of Designs of the Chicago Terminal Improvement of the Illinois Central Railroad.*

December, 1926—"Engineering and Recent Locomotive Developments." By *W. E. Woodard, Vice President, Lima Locomotive Works, Inc.*

January, 1927—"The Other Fellow's Viewpoint." By the *Hon. Dwight Lewis, Chairman Railroad Commissioners of Iowa;* "Metal Cutting Tools." By *A. H. d'Arcambal, Pratt & Whitney Company*; "Oxygen the Wonder Worker." By *G. E. Harcke, Air Reduction Sales Company.*

February, 1927—"Safety from a Public Officers' Viewpoint." By *F. T. Singleton, Public Service Commissioner of Iowa;* "History and Development of Safety Watch and Modern Improvements." By *L. N. Cobb Ball Watch and Railroad Time Service;* "A Century of Car Manufacture." By *G. A. Richardson, Bethlehem Steel Company.*

March, 1927—"Locomotive 60,000." By *Lawford H. Fry, Metallurgical Engineer, Baldwin Locomotive Works.*

April, 1927—"Motor Transportation." By *Col. Milton L. McGrew, Mack Truck Company, Inc.*

"Arteries of Industry." By *R. N. Wire, National Tube Company.*

May, 1927—Annual Meeting and Dinner. Address by *Dr. Max Mason, President University of Chicago.*

NEW ENGLAND RAILROAD CLUB

Wm. E. Cade, Jr., 683 Atlantic Avenue, Boston, Mass., Secretary

October 5, 1926—Address by *Percy R. Todd, President of the Bangor & Aroostook Railroad.*

November 9, 1926—"Some Aspects of Canadian Pacific Railway Development." By *W. M. Neal, Assistant to Vice President, Canadian Pacific Railway Company.*

December 14, 1926—"Automatic Train Control. By *G. E. Ellis, Secretary, Committee on Automatic Train Control of the American Railway Association.*

January 11, 1927—"Motor Vehicles as Railroad Auxiliaries." By *Howard F. Fritch, Passenger Traffic Manager, Boston & Maine Railroad.*

February 8, 1927—"Feedwater Heaters on Locomotives." By *V. L. Jones, Assistant Mechanical Engineer, New York, New Haven & Hartford Railroad Company.*

March 8, 1927—Forty-Fourth Annual Meeting.

April 12, 1927—"Steel Rails." By *C. W. Gennet, Jr., Robert W. Hunt Co., Chicago.*

May 10, 1927—Annual Banquet.

ST. LOUIS RAILWAY CLUB

B. W. Frauenthal, Drawer 24, M. & P. O., St. Louis, Mo., Secretary-Treasurer

May, 1926—"Progress and Possibilities in Safety." By *T. H. Carrow, Chairman, Safety Section American Railway Association, Philadelphia, Pa.*; "Preventive Medicine for Railroads." By *Charles Dillon, Managing Editor, Railway Review, Chicago, Ill.*

July, 1926—"Safety." By *L. W. Baldwin, President, Missouri Pacific Railroad Company.*

August, 1926—"Making Their Own." By *Robert E. Einstein, Secretary, Manganese Track Society.*

September, 1926—"Railroad Efficiency." By *Samuel O. Dunn, Editor, Railway Age, Chicago, Ill.*

October, 1926—"Railroad Romance." By *Merle W. Dancy, General Agent, Chicago & Alton Railroad Company, St. Louis, Mo.*; "Smoke Prevention," by *Osborn Monett, Consulting Engineer, Smoke Abatement League of St. Louis.*

November, 1926—"Rapid Transit." By *C. E. Smith, Consulting Engineer, City of St. Louis.*

December, 1926—"The Start of the Second Century of Modern Transportation." By *Col. Albert T. Perkins, Manager for the Receiver, United Railways Company of St. Louis.*

January, 1927—"Expansion Program of the Missouri Pacific in the Southwest." By *E. A. Hadley, Chief Engineer, Missouri Pacific Railroad Company.*

February, 1927—"How Abraham Lincoln would operate a Public Utility." By *J. B. Sheridan, Secretary, Missouri Committee on Public Utility Information.*

March, 1927—"Is the Public Demanding a Transportation System, that is Unnecessarily Expensive to the People." By *William G. Bierd, Receiver, Chicago & Alton Railroad, Chicago.*

April, 1927—"The Railroad Game." By *Edward F. Flynn, Assistant to Vice President and General Counsel, Great Northern Railroad, St. Paul, Minn.*

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB

A. T. Miller, 120 E. Hunter St., Atlanta, Ga., Secretary

July, 1926—"The Advantages of Organization and the Maintenance of Motive Power." By *A. G. Pack, Chief Inspector, Bureau of Locomotive Inspection, I. C. C., Washington, D. C.*

September, 1926—"Application of the Oil Electric Locomotive to Railroad Transportation." By *W. L. Garrison, Ingersoll-Rand Company, New York.*

November, 1926—"Lacquer Finishes as Applied to Passenger Cars." By *H. Hengeveld, Master Painter, Atlantic Coast Line Railroad, Waycross, Ga.;* "Lacquer Finishes as Applied to Passenger Cars and Locomotives. By *R. M. Cook, District Manager, Railway Sales, E. I. DuPont De Nemours & Company, Parlin, N. J.*

January, 1927—"The Arteries of Industry." *The National Tube Company, Atlanta, Ga.;* "Modern Locomotive Design and Its Influence upon Railway Operation." By *W. E. Woodard, Vice President, Lima Locomotive Works, Inc., New York, N. Y.*

March, 1927—"Some Considerations on the Practice of Milling." By *A. N. Goddard, President, Goddard & Goddard Company, Detroit, Mich.*

May, 1927—"The Stores Department from the User Standpoint." By *F. P. Pfahler, Assistant to Chief of Motive Power & Equipment, Seaboard Air Line Railway, Savannah, Ga.;* "The Purchase and Stores Department." By *J. L. Bennett, Purchasing Agent, Central of Georgia Railway Co., Savannah, Ga.*

CANADIAN RAILWAY CLUB

Charles R. Crook, 129 Charron St., Montreal, Que. Secretary

September 14, 1926—"Box Car Side Frame Design." By *R. M. Mochrie, Draughtsman, Canadian Pacific R. R., Montreal.*

October 12, 1926—"The Fuel Problem of Canada." By *Leslie R. Thomson, Consulting Engineer, Montreal.*

November 9, 1926—"Transportation." By *C. R. Moore, General Superintendent Transportation, C. N. Rys., Toronto.*

December 14, 1926—"Lubricants & Lubrication." By *J. Duguid, Galena Signal Oil Company, Franklin, Pa.*

January 11, 1927—"Grinding—and its Service to the World." By *Howard W. Dunbar, Assistant General Sales Manager, Norton Co., Worcester, Mass.*

February 15, 1927—"New Developments in Mining, Pulp & Paper Power, and Settlement, in North Eastern Canada." By *C. T. Young, Superintendent Development, Canadian National Railways, Toronto.*

March 8, 1927—"Informal Talk on the Post Office and Railways." By *P. T. Coolican, Assistant Deputy Post Master General, Ottawa, Ont.*

April 12, 1927—"Oxygen—The Wonder Worker." By *W. H. Ludington, Manager of Sales, Air-Reduction Sales Company, New York.*

May 10, 1927—"Annual Meeting."

THE CLEVELAND RAILWAY CLUB

F. L. Frericks, 14416 Alder Avenue, Cleveland, Ohio Secretary and Treasurer

October, 1926—"Improving the Standard of Supervision." By *Roy V. Wright, Managing Editor, Railway Age, New York, N. Y.*

November, 1926—"Freight Car Inspection." By *A. J. Krueger, Master Car Builder, Nickel Plate Railroad, Cleveland, O.*

December, 1926—"Progress and Possibilities of Safety." By *T. H. Carrow, Supervisor of Safety, Pennsylvania Railroad, Philadelphia, Pa.*

January, 1927—Annual Meeting—No Paper.

February, 1927—Discussion of the changes in the 1927 A. R. A. Rules.

March, 1927—Discussion of the changes in the 1927 A. R. A. Rules.

April, 1927—"Car Department Progress." By *M. E. Towner, General Purchasing Agent, Western Maryland Railway, Baltimore, Md.*

May, 1927—"How to Improve Design in Maintenance of Cars." By *F. J. Herter, Engineer of Rolling Stock, Nickel Plate Railroad, Cleveland, O.*

June, 1927—"The Electrification of Steam Railroads." By *W. D. Bearce, Statistician, General Electric Company, Schenectady, N. Y.*

THE MEETINGS OF THE SOCIETY ARE HELD EVERY OTHER YEAR AT ATLANTIC CITY IN CONNECTION WITH THE CONVENTIONS OF THE MECH. DIV., AMERICAN RAILROAD ASSOCIATION, THE DATES FOR WHICH IN 1928 ARE JUNE 13-20.

Chairman, C. R. Crook, *Canadian Railway Club*
Vice Chairman, A. T. Miller, *S. and S. W. Ry. Club*
Secretary-Treasurer, HARRY D. VOUGHT, *New York Railroad and Central Railway Clubs, New York, N. Y.*

OFFICIAL PROCEEDINGS

RAILWAY CLUB OF PITTSBURGH

$1.00 Per Year 25¢ Per Copy

Vol. XXVI. OCTOBER 27, 1927. No. 9.

ANNUAL MEETING—ELECTION OF OFFICERS—LIST OF MEMBERS

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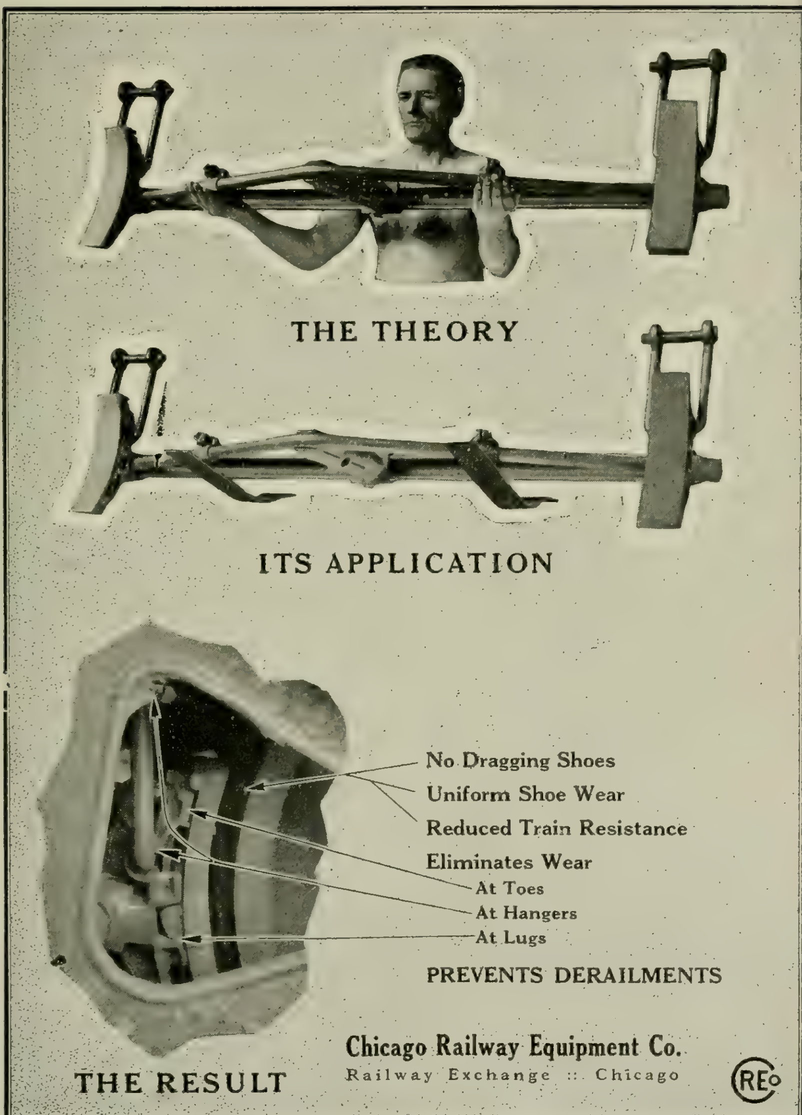
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THE RESULT
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OFFICIAL PROCEEDINGS

OF

The Railway Club of Pittsburgh

Organized October 18, 1901

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Vol. XXVI No. 9. **Pittsburgh, Pa., October 27, 1927.** $1.00 Per Year 25c Per Copy

Meetings held fourth Thursday of each month except June, July and August.

PROCEEDINGS OF ANNUAL MEETING
OCTOBER 27, 1927

The meeting was called to order at the Fort Pitt Hotel, Pittsburgh, Pa., at 8:00 o'clock P. M., President G. W. Wildin in the chair.

The following gentlemen registered:

MEMBERS

Adams, W. A.
Ainsworth, J. H.
Allderdice, Norman
Allen, Harvey
Allison, John
Altsman, W. H.
Ambrose, W. F.
Anger, C. E.
Arnold, J. J.
Ashton, William
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Batchelar, E. C.
Battenhouse, J. M.
Beam, E. J.
Bednar, Joseph J.
Berg, Karl
Berghane, A. L.
Bowery, Frank J.
Boyle, Edward A.
Bradley, W. C.
Brinkhoff, W. H.
Brower, J. E.
Brown, C. C.
Brueckner, A. J.
Burel, W. C.
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Burkholder, G. M.
Campbell, J. T.
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Carson, G. E.
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Chittenden, A. D.
Clements, F. C.
Conlon, John F.
Conway, J. D.
Cotter, G. L.
Coulter, A. F.
Courtney, H.
Coy, S. C., Jr.
Crawford, D. F.
Crawford, G. M.
Croke, Thomas F.
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Cunningham, R. I.
Dalzell, W. E.
Dambach, C. O.
Davis, Charles S.
Dehne, George C.
Dempsey, P.
Depner, Michael
Doescher, Louis
Doran, F. E.
Downs, J. R.
Durkin, James E.
Eckerson, H. D.
Edwards, C. H.
Eichorn, T. F.
Emery, C. W.
Emery, E.
Fagan, R.
Faix, Joseph
Falkner, A. J.
Farrington, Arthur R.
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Fendner, W. J.
Fenton, H. H.
Fieldson, P. H.
Fike, James W.
Fisher, G. M.
Fleckenstein, August
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Fritz, A. A.
Furch, G. J.
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Gellatly, William R.
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Givler, Hugh C.
Glenn, J. H.

Goda, P. H.
Godfrey, C. H.
Gorby, F. E.
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Grieve, R. E.
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Hansen, William C.
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Holmes, E. H.
Homer, William
Honsberger, G. W.
Hood, J. M.
Hudson, W. L.
Hunter, Bernard E.
Hussong, Albert C.
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Jahnke, Karl W.
Jenkner, Oscar
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Johnston, W. A.
Jungbluth, Adolph
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Kelin, H. S.
Kelly, H. B.
Kelly, J. P.
Kennedy, A. R.
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Ketterer, Frederick P.
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Stewart, L. S.
Stritzinger, Frank
Strohmer, John L.
Stucki, A.
Suckfield, G. A.
Sutherland, L.
Sykes, A. H.
Trust, J. F.
Tucker, J. L.
Turner, E. A.
Van Wormer, George M.
Walther, G. C.
Warfel, J. A.
Warren, A. T.
Warrensford, Fred S.
Waterman, E. H.
Wheatley, William
Whitaker, U. A.
Wildin, G. W.
Williams, A. G.
Wilson, D. L.
Wilson, George F.
Winslow, S. H.
Winwood, H. M.
Wolf, H. M.
Wood, E. H.
Wright, O. L.
Wright, John B.
Wynn, Charles A.
Wynn, H. R.
Wynne, F. E.
Fyke, J. W.
Zilian, R. F.
Zollinger, S. W.

VISITORS

Ainor, J. C.
Anderson, William
Anger, J. G.
Atkins, H. E.
Bachner, M. G.
Barrie, J. S.
Becker, W. K.
Beemer, C. A.
Bell, D. H.
Bell, W. G., Jr.
Bennett, E. H.
Berkoben, Charles, Jr.
Berner, John
Bishop, W. L.
Blest, M. C.
Bochert, C. G.
Bosley, N. D.
Bott, William J.
Bowen, J. V.
Bowers, J. M.
Brown, R. J.
Brower, William H.
Burgess, T. S.
Burkley, W. E.
Calvert, John
Carmer, C. T.

Carnot, James
Carr, A. T.
Carroll, F. E.
Carroll, W. S.
Carter, J. L.
Chalmers, J. W.
Capro, Thomas
Clatty, John H.
Clifford, E. T.
Cobbett, A. J.
Cohen, Alfred J.
Colclaser, L. A.
Cole, J. A.
Colgan, H. J.
Craig, James A.
Crux, Clarence A.
Cunningham, H. L.
Davis, William B.
Dean, W. E.
Devey, S. G.
Dickson, H. B.
Diettrich, John
Doemling, George
Doemling, James J.
Drake, E. B.
Driscoll, F. X.
Drylie, W. A.
Ekis, E. I.
Emery, F.
Erskin, J. B.
Fletcher, A.
Ford, William E.
Forrester, J. B.
Fox, George W.
Francis, A. E.
Fundis, W. A.
Funfar, James
Galbraith, Robert M.
Gillen, J. B.
Gollmar, Charles W.
Gore, James
Groh, F. W.
Groves, David
Hall, J. M.
Harris, Francis C.
Haworth, M. E.
Hayes, George W.
Heinsberg, A. H.
Helbling, C. P.
Herbst, Frank A.
Herrick, A. S.
Herzog, G. A.
Hetzel, L. C.
Hildenbrand, L. B.
Hill, J. E.
Hortenstine, H. R.
Horton, H. R.
Hunter, P. E.
Jahnke, Edward J.
Janis, G. L.
Jedinak, Joseph
Jeffries, J. B.
Johns, L. D.
Johnston, E. E.
Justus, I. J.
Kelin, A. W.
Kennedy, J. P.
Kenny, T. A.
Kiefer, Fred L.
King, James W.
Kirkpatrick, W. R.
Klue, Henry
Kohl, C. F.
Kohl, C. G.
Kramer, G. S.
Ladley, Robert
Later, J.
Laurent, A. J.
Leck, G. J.
Leckey, Ralph F.
Ledger, William M.
Lees, Harry
Lees, Thomas
Lewis, S. B.
Lincoln, Abe.
Loghi, Harry
Longabaugh, John R.
MacDonald, J. S.
Maloney, J. J.
Matthews, R. J.
Mertz, Charles W.
Meyers, G.
Miller, J. E.
Misner, George W.
Mitchell, William J.
Myers, A. M.
Myers, Charles C.
Myers, Francis C.
McConahey, S. C.
McCrudden, Frank A.
McCurdy, Clyde V.
McCurdy, James W.
McFadden, John M.
McKay, R. J.

McLaughlin, L. S.
McMillan, A. P.
Neeb, Harry A., Jr.
Neely, Harold
Nicholas, Arthur D.
Paret, H. W., Jr.
Parsons, Frank U.
Payne, H. A.
Petrie, C. F.
Petrie, John S.
Petrie, William J.
Pettigrew, F. A., Jr.
Phlegar, A. B.
Pomrenke, S. G.
Pope, R. L.
Poseman, Hugh W.
Prouty, Ralph H.
Pyle, P. S.
Reese, Frank
Rehlin, T. G.
Reich, R. H.
Rhine, C. J.
Robson, Joseph
Rodda, G. A.
Rodgers, C. W.
Rogers, W. R.
Rumsey, T. O.
Schaacke, William
Schrontz, Samuel B.
Schuck, L. P.
Schultz, A. J.
Schmid, W. L.
Shafer, John S.
Shipe, W. E.
Shropshire, Paul
Sieffert, William F.
Skiles, William C.
Smith, F. K.
Snyder, Samuel, Jr.
Sommers, Fred F.
Spray, C. L.
Stambach, A.
Stoehr, Arthur L.
Stuart, F. W.
Sundhohn, F. J.
Supinger, H. B.
Sykes, Arthur
Tarr, George H.
Taylor, W. O.
Teckemeyer, F.
Shimer, J. H.
Thomson, James D.
Thornton, Harley P.
Thrall, O. B.
Tucker, James B.
Van Dalsen, G. A.
Vogel, E. E.
Wallace, H. L.
Walters, Frank George, Jr.
Welch, Edward M.
Wickline, H. C.
Wike, D. B.
Wilbraham, E. L.
Williamson, J. A.
Willman, T. F.
Wynne, B. E.
Yorke, P. H.

The call of the roll was dispensed with, the record of attendance being obtained through the registration cards.

The reading of the minutes of the last meeting was dispensed with as they have appeared in printed form and distributed to the members.

The Secretary read the following list of applications for membership:

Anger, John G., General Foreman, P. & L. E. R. R., Fifth Avenue, Coraopolis, Pa. Recommended by Samuel Lynn.

Bachner, Martin G., Piece Work Inspector, P. & L. E. R. R., 1109 Church Avenue, McKees Rocks, Pa. Recommended by Samuel Lynn.

Barclay, J. R., Cost Engineer, P. & L. E. R. R., 4 Oakwood Road, Crafton, Pittsburgh, Pa. Recommended by F. J. Nannah.

Beatty, George W., Piece Work Inspector, P. & L. E. R. R., Dickerson Run, Pa. Recommended by Samuel Lynn.

Bowen, James T., Car Foreman, Union Railroad, North Bessemer, Pa. Recommended by A. F. Coulter.

Brose, J. A., Mechanical Inspector, P. & L. E. R. R., McKees Rocks, Pa. Recommended by Samuel Lynn.

Carthew, John W., Engineer of Inspection, Westinghouse Air Brake Company, 241 Welsh Avenue, Wilmerding, Pa. Recommended by G. W. Wildin.

Clatty, John H., Manager, Harley Burial Vault Company, 720 Washington Road, South Hills, Pittsburgh, Pa. Recommended by A. H. Sykes.

Cohen, Alfred J., Westinghouse Air Brake Company, 6832 Simonton Street, Pittsburgh, Pa. Recommended by G. W. Wildin.

Corcoran, James M., Inspector, Monongahela Connecting Railroad, 4002 Coleman Street, Pittsburgh, Pa. Recommended by G. H. Mertz.

Creighton, David M., Engineering Computer, P. & L. E. R. R., 717 Tenth Avenue, New Brighton, Pa. Recommended by F. J. Nannah.

Doyle, William E., Assistant Chief Clerk to Master Car Builder, P. & L. E. R. R., 912 Liberty Street, McKees Rocks, Pa. Recommended by Samuel Lynn.

Fitzpatrick, F. R., General Coal Freight Agent, P. & L. E. R. R., 212 Lexington Avenue, Aspinwall, Pa. Recommended by J. E. Hughes.

Francis, G. E., General Foreman, Pennsylvania Railroad Company, E. & M., Juniata Shops, Altoona, Pa. Recommended by O. L. Wright.

Frauenheim, A. L., Sales Engineer, Standard Auto-Tite Joint Company, Park Building, Pittsburgh, Pa. Recommended by Norman Allderdice.

Graham, A. C., Traffic Manager, Youngstown Sheet & Tube Company, 80 Mill Creek Drive, Youngstown, Ohio. Recommended by J. E. Hughes.

Harris, Francis C., Yard Clerk, Carnegie Steel Company, 1118 Franklin Avenue, North Braddock, Pa. Recommended by O. L. Wright.

Hastings, Walter S., R. F. of E., Alliquippa & Southern Railroad, Woodlawn, Pa. Recommended by W. F. Ambrose.

Hayes, George W., Air Brake Foreman, P. & L. E. R. R., 1225 Vance Avenue, Coraopolis, Pa. Recommended by Samuel Lynn.

Hewlett, H. D., Foreman, P. & L. E. R. R., 613 Island Avenue, McKees Rocks, Pa. Recommended by Samuel Lynn.

Jack, Arthur C., Engine Track Appliances, Carnegie Steel Company, Carnegie Building, Pittsburgh, Pa. Recommended by Charles Orchard.

Johnston, E. E., Engineer, Westinghouse Electric & Manufacturing Company, 111 Seventh Street, Turtle Creek, Pa. Recommended by C. L. Painter.

Keefe, Edward A., Coal Billing Agent, B. & O. R. R., 112 Grandview Avenue, Pittsburgh, Pa. Recommended by G. H. Mertz.

Kennedy, F. D., Superintendent Railway Department, Westinghouse Electric & Manufacturing Company, 242 Bevington Road, Wilkinsburg, Pa. Recommended by E. J. Bald.

Kleber, Charles J., Piece Work Inspector, P. & L. E. R. R., R. F. D. 1, Box 104, McKees Rocks, Pa. Recommended by Samuel Lynn.

Lambert, G. J., Superintendent Transportation, Pittsburgh Steel Company, 910 Broad Avenue, Belle Vernon, Pa. Recommended by J. E. Hughes.

Leckey, Ralph F., Secretary and Treasurer, William M. Bailey Company, 721 Penn Street, North Braddock, Pa. Recommended by J. D. Conway.

Lees, Thomas, Cigar Manager, Reymer & Brothers, Inc., 4128 Franklin Road, North Side, Pittsburgh, Pa. Recommended by J. D. Conway.

Lincoln, John J., Jr., Air Reduction Sales Company, 1116 Ridge Avenue, North Side, Pittsburgh, Pa. Recommended by J. A. Warfel.

Marsh, F. E., Salesman, Nathan Manufacturing Company, 250 Park Avenue, New York, N. Y. Recommended by E. J. Searles.

Meyer, G. K., Clerk, P. & L. E. R. R., 3407 Shadeland Avenue, North Side, Pittsburgh, Pa. Recommended by P. C. Sanfillip.

Munn, Alex D., First Aid Inspector, P. & L. E. R. R., Glenwillard, Pa. Recommended by A. H. Sykes.

McCarthy, William A., Chief Car Inspector, Lehigh & New England Railroad, P. O. Box 283, Progress, Pa. Recommended by George M. Van Wormer.

McKay, R. J., Vice President, A. O. Norton, Inc., 310 South Michigan Avenue, Chicago, Ill. Recommended by O. L. Wright.

McKean, Joseph D., Piece Work Inspector, P. & L. E. R. R., 401 Lorenz Avenue, Pittsburgh, Pa. Recommended by Samuel Lynn.

McMillan, A. P., Boiler Foreman, P. & W. Va. Ry., 114 Fourth Avenue, Pittsburgh, Pa. Recommended by T. E. Cannon.

Pearson, H. B., Jr., Sales Engineer, Bethlehem Steel Company, Oliver Building, Pittsburgh, Pa. Recommended by V. H. Miessner.

Prentice, L. V., Assistant Station Master, P. & L. E. R. R., 258 Southern Avenue, Pittsburgh, Pa. Recommended by J. D. Conway.

Reid, Samuel, Inspecting Engineer, P. & L. E. R. R., 411 Eleventh Street, Beaver Falls, Pa. Recommended by F. J. Nannah.

Rodda, G. A., Engineer, P. H. B. & N. C. Ry., Harmony, Pa. Recommended by W. H. Altsman.

Schaacke, William, Car Inspector, Woodlawn & Southern Street Railway Company, 112 Ruth Street, Pittsburgh, Pa. Recommended by Joseph Showalter.

Schneider, G. August, Vice President, Rees Manufacturing Corporation, Thomas Boulevard, Pittsburgh, Pa. Recommended by W. R. Gellatly.

Semmer, M. R., Salesman, Air Reduction Sales Company, 6205 Stanton Avenue, Pittsburgh, Pa. Recommended by William C. Hansen.

Simmons, William H., General Foreman, P. & L. E. R. R., Dawson, Pa. Recommended by Samuel Lynn.

Smith, Walter S., Gang Foreman, P. & L. E. R. R., Dawson, Pa. Recommended by Samuel Lynn.

Stoffregen, Louis E., Draftsman, P. & L. E. R. R., 213 Grandview Avenue, Mt. Washington, Pittsburgh, Pa. Recommended by F. J. Nannah.

Teckemeyer, Fred, Gang Foreman Freight, P. & L. E. R. R., 3042 Glenmawr Avenue, Pittsburgh, Pa. Recommended by Samuel Lynn.

Vandivort, Robert E., Assistant Inspecting Engineer, P. & L. E. R. R., 714 East End Avenue, Pittsburgh, Pa. Recommended by F. J. Nannah.

PRESIDENT: These applications will be referred to the Executive Committee in due course, and upon approval by them, the gentlemen will become members without further action.

I desire at this time to make a report of the Inspection Trip to the plants of the Carnegie Steel Company.

It is appropriate to mention that The Railway Club of Pittsburgh were guests of the Carnegie Steel Company on a visit to their Schoen Wheel Company plant at McKees Rocks and their new electrical mill at Homestead, on Thursday, October 20, 1927. The Carnegie Steel Company provided a special train of six coaches, hauled by a modern P. & L. E. passenger locomotive, to convey the members and their guests to both plants where they were received and conducted through the mills, where demonstrations were made of the making of Forged Steel Wheels at McKees Rocks and the rolling of Beams and Plates at the Homestead Plant. This latter mill is modern in every respect and both visitations were of great interest and appreciated by those in attendance.

Following the inspection of the Homestead Plant dinner was served at the mill to all present there being some 300 members present.

This is a very fine showing of attendance by our Club and we are very deeply indebted to the Carnegie Steel Company for their invitation to visit these modern plants. I am glad so many of you took advantage of the opportunity and went along. I understand there were really about 350 in the party though our records only show 300.

This being the annual meeting, the next thing in order is the report of the election of officers. You are familiar with our method of voting for officers by letter ballot, and it is

only necessary now to read the result of the ballot as computed by the tellers. I will ask the Secretary to read the Report of the Tellers.

SECREARY: The ballots received for the election of officers of The Railway Club of Pittsburgh for the ensuing year totalled 307. The ballot resulted in the unanimous election of the following:

PRESIDENT—E. J. Devans, General Superintendent, B. R. & P. Ry. Co.

FIRST VICE PRESIDENT—F. W. Hankins, Chief of Motive Power, P. R. R.

SECOND VICE PRESIDENT—W. S. McAbee, General Superintendent, Union R. R. Co.

SECREARY—J. D. Conway.

TREASURER—E. J. Searles, Schaefer Equipment Company.

EXECUTIVE COMMITTEE—L. H. Turner, Chairman; Frank J. Lanahan, D. J. Redding, A. Stucki, Samuel Lynn, D. F. Crawford, F. G. Minnick, G. W. Wildin.

MEMBERSHIP COMMITTEE*—J. E. Hughes, Chairman, 2 years; Col. James Milliken, 1 year; J. T. Campbell, 1 year; A. P. Schrader, 1 year; J. L. Cunningham, 2 years; C. M. White, 2 years; H. G. Huber, 2 years; A. F. Coulter, 2 years; Otis R. Hale, 3 years; E. A. Rauschart, 3 years.

SUBJECT COMMITTEE*—Prof. Louis E. Endsley, Chairman, 2 years; J. A. Ralston, 2 years; A. M. Candy, 3 years.

FINANCE COMMITTEE*—John B. Wright, Chairman, 2 years; T. M. Blakley, 3 years; J. H. Carroll, Jr., 3 years; W. P. Cunningham, 3 years; W. C. Hansen, 3 years.

ENTERTAINMENT COMMITTEE*—Henry F. Gilg, Chairman, 1 year; S. E. Van Vranken, 1 year; Norman Allderdice, 2 years.

RECEPTION COMMITTEE*—H. E. Passmore, Chairman, 1 year; M. A. Smith, 1 year; Col. H. C. Nutt, 1 year; Robert Rogers, 1 year; A. B. Severn, 2 years; L. V. Stevens, 2 years; O. L. Wright, 3 years.

*In addition to newly elected committee members, the above list also gives names of those previously elected whose terms of office have not expired.

PRESIDENT: I am sorry to say that we have word from our President-elect that it is impossible for him to be here on account of very urgent business, but he has sent a communication which I will ask the Secretary to read.

Buffalo, Rochester & Pittsburgh Railway Company,

Rochester, N. Y., October 22, 1927.

Mr. J. D. Conway, Secretary,
The Railway Club of Pittsburgh,
Pittsburgh, Pa.

Dear Mr. Conway:

I am quite sure I will not be able to get away for next Thursday night's meeting. We are still in conference and I expect will be here all of next week.

Sincerely yours,

E. J. DEVANS.

PRESIDENT: I do not see the First Vice President-elect, Mr. F. W. Hankins, Chief of Motive Power, P. R. R. If he is in the room I would like to have him come forward and make his bow to the congregation.

The Second Vice President-elect, Mr. W. S. McAbee, General Superintendent of the Union Railroad, is here and we want to see him and have a word from him.

MR. W. S. McABEE: Gentlemen, I do not know how to thank you for what you have done tonight. I did not aspire to this office. I never worked for it, and I do not know whether this thing of giving something to somebody who does not work for it is the best thing in the end. But I will promise you my very best endeavor to perform all the duties of the office to which you have seen fit to elect me.

PRESIDENT: You have elected a new Treasurer tonight, Mr. E. J. Searles. Mr. Stark has been our Treasurer for many, many years, but on account of his health and other things he feels that he should give up the duties of Treasurer. Therefore in compliance with his desire we have elected Mr. Searles. I am very sorry to say that Mr. Searles had to be out of the city tonight.

We will now listen to the Annual Report of the Secretary

SECRETARY'S REPORT

Pittsburgh, Pa., October 27, 1927.

To the Officers and Members of
The Railway Club of Pittsburgh.

Gentlemen:

The following is a summary of membership and financial statement for the fiscal year ended October 27, 1927:

Reported last year	1245	
Received into membership during the year	186	
Reinstated	2	
		1433
Suspended, non-payment of due	86	
Resigned	59	
Loss of address	12	
Deaths reported during the year	17	
		174
Present membership		1259

Of the above membership four are honorary. They are: D. C. Buell, Samuel O. Dunn, Julian Kennedy and John A. Penton.

DECEASED MEMBERS

Name	Died
L. Abair	June 19, 1927
S. Y. Baldwin	August 23, 1927
John Beswick	April 4, 1927
Frank I. Ellis	January 16, 1927
W. J. Evans	May 29, 1927
William S. Gibson	February 2, 1927
C. M. Hawkins	August, 1926
W. B. Hyde	April 15, 1927
F. A. Klinefelter	October 24, 1926
L. E. Osborne	January 30, 1927
Hon. James H. Reed	June 17, 1927
D. S. Rice	October 29, 1926
William F. Ryan	February 9, 1927
J. V. Styers	January 28, 1927
E. K. Thomas	July 3, 1927
H. B. Thurston	March 25, 1927
C. L. Welty	July, 1925

FINANCIAL

Receipts

In hands of Treasurer at close of last year...	$6,230.67	
From advertisements	2,278.55	
From dues	3,366.00	
From sale of Proceedings....................	19.60	
From sale of tickets, Dance, February 22, 1927	883.20	
Smoker tickets and dinner, October 28, 1926..	901.00	
From interest, Liberty Bonds and bank balance	188.45	
		$13,867.47

Disbursements

Printing Proceedings, Notices, Mailing, etc...	2,891.40	
Hall, luncheons, cigars, etc.................	828.35	
Reporting Proceedings	180.00	
Luncheon, Entertainment, etc., Smoker, October 28, 1926........................	803.05	
Messenger Service, Affidavits, etc...........	19.00	
Moving Pictures and Radio...................	60.00	
Premium on Bonds, Treasurer and Secretary.	17.50	
Expenses of Dance, February 22, 1927.......	797.22	
Dues, Society Railway Club Secretaries......	15.00	
Salaries and advertising expenses............	1,227.85	
		6,839.37
Net Balance		$ 7,028.10

Cash is made up of $4,028.10 and $3,000.00 in Liberty Bonds.

J. D. CONWAY, Secretary.

Approved:

L. H. TURNER, Chairman,

FRANK J. LANAHAN, SAMUEL LYNN,
D. J. REDDING, D. F. CRAWFORD,
A. STUCKI, F. G. MINNICK,

Executive Committee.

PRESIDENT: Next will be the report of the Treasurer. I will ask the Secretary to read the report, in the absence of Mr. Stark:

TREASURER'S REPORT

To the Officers and Members of
The Railway Club of Pittsburgh.

Gentlemen:

I herewith submit Treasurer's Report for the year ended October 27, 1927:

ON HAND AND RECEIPTS

On hand October 28, 1926	$3,230.67	
Cash received from J. D. Conway, Secretary	7,448.35	
Interest on Liberty Bonds	127.50	
Interest on bank balance	60.95	
Total		$10,867.47

DISBURSEMENTS

Paid on Secretary's vouchers Nos. 575 to 616, inclusive	6,839.37
Balance	$ 4,028.10

RESOURCES

Three Liberty Bonds, $1,000.00 each	3,000.00	
Cash balance on hand October 27, 1927	4,028.10	
Total		$ 7,028.10

F. H. STARK, Treasurer.

Approved:

L. H. TURNER, Chairman,
FRANK J. LANAHAN, SAMUEL LYNN,
D. J. REDDING, D. F. CRAWFORD,
A. STUCKI, F. G. MINNICK,
Executive Committee.

We have audited the accounts of the Secretary and Treasurer and find them correct as reported.

C. O. DAMBACH, Chairman,
E. J. SEARLES,
JOHN B. WRIGHT,
Members of Finance Committee.

Upon motion, the reports were accepted and directed to be inserted in the minutes of the meeting.

PRESIDENT: I think we will all agree that that is a very excellent report.

Before closing our business meeting this evening I wish to make just a few remarks, after which I will turn the meeting over to the Entertainment Committee, Mr. Henry Gilg, Chairman.

As the Secretary has reported, our membership has had a gain of fourteen members during the past year, notwithstanding we had a very large number of our members called by death. In addition, we started in at the beginning of the year to clean up our membership roll. We had a number on the membership roll who had not paid dues and it was necessary to make a clean sweep in order to get a good healthy membership on our books, and yet we have come out with a net gain of fourteen members, which is very gratifying.

Our financial report also ought to be very encouraging. We have made a gain of something over $800 over last year, notwithstanding the heavy drainage we have had on our treasury. We now have the second largest cash balance of any railway club east of Chicago, or, I might say, in the United States. I think we are only exceeded by the New York Railroad Club, and they have almost double the membership we have.

Upon turning the gavel over to my successor I want to thank every member of every committee that has been working with me during the year that has just passed. I have had wonderful support and I think we have made good progress. If you will give the same support to my successor that you have given me there is no reason why this Club should not continue to advance during the coming year and do even greater things than they did this past year. I want to thank you one and all for your good will. It has been splendid. It has been a pleasant year for me, though I have mostly passed the burdens on to some one else. I can say that I have enjoyed every minute of it. I thank you.

SECRETARY: The President having been relieved from duty by his own motion, and having turned the meeting over to the Entertainment Committee for completion of the program, I should like to say a few words: It has been a pleasure and my privilege to have been associated with our retiring President, Mr. Wildin, during the past year in the work of the Club. He is always an agreeable fellow and that made for harmony.

Everybody looks happy tonight; there seems to be a spirit of good fellowship among us and if I judge correctly there appears to be a sort of anticipatory look on the multitude of faces in the audience. This can hardly be considered out of place at this time as we have a real treat coming, but before coming to that this anticipated expression should be both analyzed and satisfied, there being but a few on the inside of what is to follow. In fact, there are a number of things coming on that we are looking forward to with considerable suspense.

Among others that come to my mind at the moment is Henry Ford, that national, or rather, international man who has created wonderful things in the transportation line. No doubt we are all wondering just what Henry had in mind in the way of transportation. Most of us have a car of some sort and all of us have an ambition to have some sort of a car. I have been asked if I could give any information as to the character and description of this unknown product that we have been waiting to see—what it looks like, what it will do, etc. It will undoubtedly be of interest to members to know that this Club has secured the first model and will place it on display on this platform, that the audience may know and see for themselves just what it is. Our audience made up as it is of railroad men and supply men, as we like to term the latter, and they are all good fellows on both sides, more particularly the supply side.

Now if the doors are sufficiently wide to let in this latest Ford Model, I would like to have it brought to the platform. (At this point a very elaborate plate glass tea wagon, with Japanese hand-painted design, was wheeled into the room and placed on the platform.) Now that we have shown you this latest model, no doubt the mechanical men present will want to know something about its specifications:

It has a wheel base of 39 7/16 inches,
Seats as many as can get in without crowding,
Beautiful air line body,
Has drop sides—a new and radical departure in body design,
Comes in any color preferred and includes your family Coat of Arms,
Westinghouse air brakes on all wheels,
Guaranteed to break all speed limits,
Requires neither oil nor gas,
Guaranteed to last even to the next generation.

I wonder if there is any more equipment that goes with this car. (At this point a very handsome solid silver tea set was brought in and placed on the wagon.) Mr. Wildin, retiring President, this token of regard is one that represents the spirit of good fellowship which by long established custom prevails at this period of our Annual Meeting. It may be you had some idea ere this that it was customary to remember the retiring president at our annual meeting with some such gift, but you did not know what that might be—so this may be considered your surprise. This comes to you not altogether for its intrinsic value but as an expression of the affectionate regard in which you are held by your fellow Club members over whom it has been your good pleasure to preside during the past year. In the years to come we trust it will be a reminder of the sentiment and expression of feeling and regard in which you are held by the donors.

PRESIDENT: Mr. Conway and fellow Members of the Railway Club of Pittsburgh: This is a beautiful thing, and its beauty is representative of my appreciation of it and its donors. It will make two people happy. I am happy indeed to receive this from you gentlemen, my friends, because I realize the sentiment that goes with it. And I am sure my better half will be happy a thousand times over when she sees it. As Mr. Conway says, I do not take this for its intrinsic value alone, but rather consider it for the sentiment that it conveys, and if I were to talk all night I could say no more than that. Every time I look at it it will remind me of the many pleasant hours I have spent with you here. And my hope is that for many years to come we may all be permitted to continue that happy association and that earnest work to forward the best interests of the Club. For this beautiful token of your esteem I can only give you my sincere thanks in return and my promise to be with you in the future work of the Club, irrespective of the fact that I may be retiring as President.

I will now turn the meeting over to the Entertainment Committee, with Mr. Van Vranken immediately in charge.

MR. S. E. VAN VRANKEN: It was the idea of Mr. Gilg, our Chairman, to vary the style of the entertainment from that of professional entertainers to a class of entertainment from among our own membership. Last year the entertainers were chosen from among the railroad men. With a thought of encouraging a little rivalry, Mr. Gilg turned over the program

this year to the Supply men, and we are going to leave it to you to judge of the results.

The following Program was then presented:

PROGRAM

RAILWAY CLUB OF PITTSBURGH

ANNUAL SMOKER

October 27, 1927

REGULAR BUSINESS, ELECTION, ETC.

NATIONAL TUBE COMPANY

Christy Park Quartet

Lawrence Barnes, First Tenor
E. K. VanLoon, Second Tenor
George R. Griffith, Baritone
Earl V. Peterson, Basso

Alex A. Hoffmiester, Pianist

We Leave for Dear Old Dixie Today
Honolulu Moon
Dinah.
My Gal Sal.

NEELY NUT AND BOLT COMPANY

A Couple of Neely Nuts

Don Stitt, Banjoist "Art" Schamberg, Pianist

LOCOMOTIVE STOKER COMPANY

"Tool Music"

W. H. Abercrombiie, Sawist "Art" Schamberg, Pianist

"Only a Rosebud"
"My Wild Irish Rose"

WESTINGHOUSE AIR BRAKE COMPANY

WABCO Instrumental Quartet

Joseph D. Nirella, Trumpet
L. S. Weight, Xylophone
Thomas Birt, Saxophone
Frank L. Belfitlio, Saxophone

EDGEWATER STEEL COMPANY

Circle E. Quartet

Robert Reed, First Tenor
E. R. Beers, Second Tenor
George M. VanWhy, Baritone and Pianist
Fred W. Weber, Basso

"DeCopper Moon"
"In An Old Fashioned Town"
"Little White House"
"When Billows Are Rocking"
"Moonlight On the Lake"
"The Sunshine That Fills My World"

SECRETARY: We are reminded tonight that one of our Past Presidents, and for many years one of our most active members in the interest of the Club, cannot be with us due to

illness and it would seem both fitting and appropriate that we, who are permitted to enjoy this occasion send greetings and good will to Mr. D. J. Redding and with the hope that he may soon recover health and again join with us in our meetings and I will present this in form of a motion. It was duly seconded and carried unanimously.

SECRETARY: I would also move a vote of thanks to those firms who contributed toward the entertainment upon this occasion—The National Tube Company, The Neely Nut & Bolt Company, Locomotive Stoker Company, Westinghouse Air Brake Company and the Edgewater Steel Company. The motion was seconded by Mr. Henry F. Gilg and prevailed unanimously.

SECRETARY: While we are in the midst of resolutions, it would be remiss if we did not recognize the efforts of our Entertainment Committee under whose direction the splendid program presented tonight has been carried out. The motion was seconded and carried with enthusiasm.

Following the entertainment the Club adjourned to the dining room where a very fine luncheon was served.

J. D. CONWAY, Secretary.

CONSTITUTION

ARTICLE I

The name of this organization shall be "The Railway Club of Pittsburgh."

ARTICLE II

OBJECTS

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III

MEMBERSHIP

Section 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

Sec. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings, and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV

OFFICERS

The officers of this Club shall consist of a President, First Vice President, Second Vice President, Secretary, Treasurer, Finance Committee consisting of five or more members, Membership Committee consisting of seven or more members, Entertainment Committee consisting of three members, Reception Committee consisting of six or more members, Subject Committee consisting of three or more members, and an Elective Executive Committee of three or more members. The officers named shall serve a term of one year from date of their election, with the exception of the Finance, Membership, Entertainment, Reception and Subject Committees; the term of office of these committees shall be specified at the time of the Annual Election, but the term

of office of the members of such committees shall not exceed three years.

ARTICLE V

DUTIES OF OFFICERS

SECTION 1. The President shall preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer; also serve as a member of the Executive Committee.

SEC. 2. The First Vice President, in the absence of the President, will perform all the duties of that officer; the Second Vice President, in the absence of the President and First Vice President, will perform the duties of the presiding officer. The First and Second Vice President shall also serve as members of the Executive Board.

SEC. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club Proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

SEC. 4. The Treasurer shall receipt for all moneys received from the Secretary, and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by checque signed by the Secretary and Treasurer.

SEC. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

SEC. 6. The Finance Committee will have general supervision over the finances of the Club, and perform such duties as may be assigned them by the President or First and Second Vice Presidents.

SEC. 7. The Membership Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents and such other duties as may be proper for such a committee.

SEC. 8. The Entertainment Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents, and such other duties as may be proper for such a committee.

ARTICLE VI

ELECTION OF OFFICERS

SECTION 1. The officers shall be elected at the regular annual meeting as follows, except as otherwise provided for:

SEC. 2. Printed forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

SEC. 3. The elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

SEC. 4. The President will announce the result of the ballot and declare the election.

SEC. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot .

ARTICLE VII

AMENDMENTS

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

BY-LAWS

ARTICLE I

MEETINGS

SECTION 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Thursday of each month, except June, July and August, at 8 o'clock P. M.

SEC. 2. The annual meeting shall be held on the fourth Thursday of October each year.

SEC. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

ARTICLE II

QUORUM

At any regular or special meeting nine members shall constitute a quorum.

ARTICLE III

DUES

SECTION 1. The annual dues of members shall be Two Dollars, payable in advance on or before the fourth Thursday of September each year.

SEC. 2. The annual subscription to the printed Proceedings of the Club shall be at the published price of One Dollar. Each member of the Club shall pay for both dues and subscription. Dues and subscription paid by members proposed at the meetings in September or October shall be credited for the following fiscal year.

SEC. 3. At the annual meeting members whose dues and subscription are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

SEC. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

ARTICLE IV

ORDER OF BUSINESS

1—Roll call.
2—Reading of the minutes.
3—Announcements of new members.
4—Reports of Committees.
5—Communications, notices, etc.
6—Unfinished business.
7—New business.
8—Recess.
9—Discussion of subjects presented at previous meeting.
10—Appointment of committees.
11—Election of officers.
12—Announcements.
13—Financial reports or statements.
14—Adjournment.

ARTICLE V

SUBJECTS—PUBLICATIONS

SECTION 1. The Subject Committee will provide the papers or matter for discussion at each regular meeting.

SEC. 2. The Proceedings or such portion as the Executive Committee may approve shall be published (standard size, 6x9 inches) and mailed to the members of the Club or other similar clubs with which exchange is made.

ARTICLE VI

The stenographic report of the meetings will be confined to resolutions, motions and discussions of papers unless otherwise directed by the presiding officer.

ARTICLE VII

AMENDMENTS

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

MEMBERS

Aaron, C. T.
P. & L. E. R. R.,
815 Romine Avenue,
McKeesport, Pa.

Abbott, J. A.,
Asst. Trainmaster,
Western Maryland Rw.,
Cumberland, Md.

Abraham, Walter S.,
Inspector,
Westinghouse Air Brake Co.,
P. O. Box 666,
E. McKeesport, Pa.

Adams, F. W.,
Local Storekeeper,
B. & O. R. R.,
Watson St.,
Hays, Pa.

Adams, Lewis,
Clerk, P. S. C. Co.,
McKees Rocks, Pa.

Adams, Walter A.,
Lubrication Inspector,
P. & L. E. R. R.,
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Glassport, Pa.

Agnew, Robert L.,
Yardmaster, P.R.R.System,
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Westmont,
Johnstown, Pa.

Aiken, Glen A.,
Vice President.
American Nut and Bolt
Fastener Co.,
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A. M. Byers Co.,
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Sec. and Treas., Commissary
Co. of America,
1665 New Haven Ave.,
South Hills Branch
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Allderdice, Norman,
President & Treasurer,
Arch Machinery Co., Inc.,
1005 Park Bldg.,
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Allen, E. J.
Salesman, Ingersoll-Rand
Company, 706 Camber
of Commerce Bldg.,
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Allen, Harvey
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Allen, Jas. P.,
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62nd and Butler Sts.,
Pittsburgh, Pa.

Allen, Raymond Lee
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P. & L. E. R. R.,
California, Pa.

Allison, John,
Sales Engineer,
Pgh. Steel Foundry Corp.,
Glassport, Pa.

Altman, C. M.,
Foremen Car Inspectors,
Penna. R. R. System,
Grapeville, Pa.

W. H. Altsman,
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Woodlawn, Pa.

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Anderson, G. S.,
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Anderson, N. P.,
Gen. Foreman,
P. & L. E. R. R.,
Wireton,
Allegheny Co., Pa.

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Upholsterer Foreman,
P. & L. E. R. R.
15 Richey Ave.,
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Anger, John G.,
General Foreman,
P. & L. E. R. R.,
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Angstadt, Edward D.,
Piece Work Inspector,
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General Refractories Co.,
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Asst. Enginehouse Foreman,
Penna. System,
Derry, Pa

Ashton, Wm. A.,
Die Foreman,
Schoen Works,
Carnegie Steel Co.,
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Atterbury, W. W.,
President, P. R. R. Co.,
Broad St. Sta.,
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Aulbach, A. J.,
Yardmaster, P. & L. E. R. R.,
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Ayers, H. B.,
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H. K. Porter Co.,
49th St. and A. V. Ry.,
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Bage, Ralph E.,
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Bailey, F. G.,
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Motor Truck Dept.,
Standard Steel Car Co.,
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Secy., Edgewater Steel Co.,
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Ball, Geo. L.,
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Balzer, C. E.,
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Barney, Harry,
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Barrett, R. L.,
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Bartholomew, W. S.,
Pres't., Loco. Stoker Co.,
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Beatty, George W.,
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Bednar, Jos. J.,
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Beegel, F. W.,
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Supt., B. & O. R. R.,
So. Windsor Apts.,
Connellsville, Pa.

Bennett, Robert George,
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P. R. R. Sys.,
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Westinghouse Air Brake Co., Wilmerding, Pa.

Bickelhaupt, Ivan A.,
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Pittsburgh-Des Moines Steel Co.,
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Bigleman, E. P.,
Yard Master,
P. & W. Va. Ry.,
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Carnegie, Pa.

Bihler, L. C.,
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Carnegie Bldg.,
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Bittner, William A.,
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Blackmore, G. A.,
Vice President & Gen. Mgr.,
Union Switch & Signal Co.,
Swissvale, Pa.

Blackwell, W. B.,
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Blair, John R.,
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Bonhoff, E. L.,
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Booth, J. K.,
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Borg, John Edw.,
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Julian Kennedy,
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Bottomly, E. S.,
Chief Joint Inspector,
P. R. R., B. & O.,
Rdg., and W. M.,
Martinsburg, W. Va.

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Ewald Iron Co.,
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Bowden, T. C.,
Coal Inspector,
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Bowen, James T.,
Car Foreman,
Union Railroad,
North Bessemer, Pa.

Bowery, Frank J.,
Chief Estimator, F. C. D.,
P. S. C. Co.,
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Division Engineer,
P. R. R. System,
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Boyce, Wm. H.,
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Boyd, T. B.,
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Standard Steel Car Co.,
Mifflin Apartments,
Butler, Pa.

Boyer, Chas. E.,
Gen. Car Inspector,
P. R. R. System,
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Boyle, Edward A.,
Salesman, The Okonite Co.,
First National Bank Bldg.,
Pittsburgh, Pa.

Braden, Lou,
District Sales Manager,
Wyoming Shovel Works,
First Nat'l. Bank Bldg.,
Pittsburgh, Pa.

Bradley, W. C.,
C. C. to Gen'l. Supt.,
Union R. R.,
1808 Lafayette St.,
Swissvale, Pa.

Brady, H. K.,
Supt., Labor & Wage Bureau,
Penna. System,
720 Penna. Station,
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Brady, T. Joseph,
President,
Vanderbilt Coal & Coke Co.,
918 House Bldg.,
Pittsburgh, Pa.

Brann, W. S.,
Superintendent Coal Docks,
Union R. R.,
Duquesne, Pa.

Brant, Wm. J.,
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Braun, L. H.,
Mechanical Engineer,
Pressed Steel Car Co.,
256 Beringer Place,
Bellevue, Pa.

Braun, Otto F.,
Gen. Mach. Shop Foreman
P. & L. E. R. R.,
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McKees Rocks, Pa.

Brautigam, H. S.,
Representative, Railroad
Dept., Allegheny Steel
Co., Brackenridge, Pa.

Brendlinger, M. T.,
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Penna. R. R. Sytem,
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Pitcairn, Pa.

Brennan, John T.,
Asst. to Vice Pres.,
Greenville Steel Car Co.,
Greenville, Pa.

Brennen, Charles H.,
Yard Clerk, P.&L.E.R.R.,
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Brewer. Geo. W.,
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Brewster, Morris B.,
Pres. & Gen. Mgr.,
Morris B. Brewster, Inc.,
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Chicago, Ill.

Brice, James A.,
Chief Train Disp's.,
P. & L. E. R. R.,
Mill Street,
Coraopolis, Pa.

Brinkhoff, W. H.,
Draftsman, P. & .L. E.
R. R., 13 Willow St.,
Emsworth, Pa.

Briscoe, James,
Mgr., Steam Specialty Dept.,
Manning, Maxwell & Moore,
1005 Park Bldg.,
Pittsburgh, Pa.

Brose, J. A.,
Mechanical Inspector,
P. & L. E. R. R.,
McKees Rocks, Pa.

Brooke, Willard,
Car Fore., Union R. R.,
R. D. No. 1.,
Verona, Pa.

Brosius, E. E.,
President,
Official Rwy. Guide Pub. Co.,
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Supt., P. & L. E. R. R. Co.,
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Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. D. Conway, Secretary, who having been duly sworn according to law, deposes and says that he is the Editor and Publisher, of the Official Proceedings—Railway Club of Pittsburgh.

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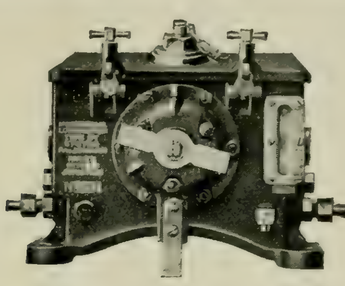

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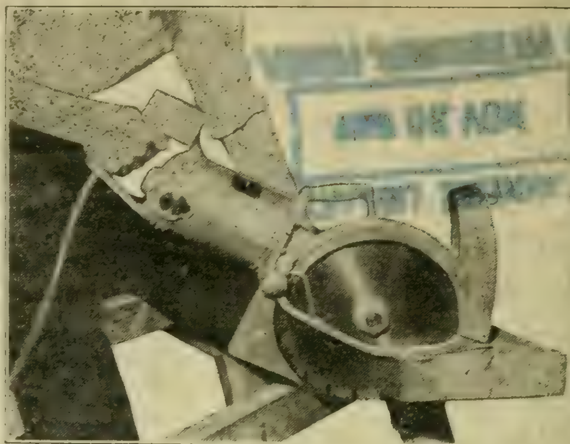

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